

# NORTH COUNTRY NATIONAL SCENIC TRAIL



A Handbook for  
Trail Design, Construction,  
and Maintenance

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North Dakota • Minnesota • Wisconsin • Michigan • Ohio • Pennsylvania • New York

# **A Handbook for Trail Design, Construction, and Maintenance**

August 1996



## **North Country National Scenic Trail**

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United States Department of the Interior • National Park Service

This book is dedicated to the  
hundreds of volunteers and partner agencies  
whose invaluable efforts made  
this trail possible.

### **PREFACE**

The North Country National Scenic Trail (NST) extends thousands of miles. It requires the participation of a myriad of individuals and groups in its layout, design, construction, and maintenance. Understandably, the level of trail experience and expectations of the finished product often differs among those involved. New volunteers commonly ask for trail standards to guide their work. In the past they were given verbal descriptions and, at best, directed to existing trail construction and maintenance handbooks prepared by other trail agencies and groups. Trail standards are fairly consistent across the nation, and these referrals were made with a certain degree of confidence. However, completed sections of the North Country National Scenic Trail are significantly different in terms of trail standards, signing, location in the area's landscape, and maintenance.

The purpose of this handbook is to lay the foundation upon which the North Country NST will achieve a degree of consistency from one segment to another. Public recognition that the trail is becoming a reality will also be gained. Workable trail standards are identified and defined in the following chapters. It is desired that over time the entire trail will utilize these standards. Local innovation is a trait that is encouraged, but ideas and changes should be channeled within the broader bounds of trailwide standards.

The legislation that created the North Country NST acknowledged that the trail's completion required cooperation among all levels of government and private organizations. The 1982 *Plan for the Management and Use of the North Country Trail* noted that total uniformity was not prescribed because of the diverse nature of managing entities. However, the plan realized that as trail use and popularity increased the importance of uniformity also would increase.

The North Country NST has matured since 1982 and more consistent application of standards is required. Increased uniformity is important for a variety of reasons: recognition and public support for the trail, provision for basic levels of safety, a degree of accessibility, improvements of poorly designed trail segments, and easier maintainability. The objective is to have all completed segments recognized as a national scenic trail.

Although total uniformity is not strictly imposed, adoption of consistent trailwide standards is desired. As old segments of trail are reconstructed, and as new trail segments are built, it is strongly recommended that these guidelines be followed. As experience in trail development and maintenance progresses and suggests changes in application, amendments will be incorporated.

It is hoped that this handbook will assist and inspire all who work for the successful completion and maintenance of the North Country National Scenic Trail.

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The North Country NST Handbook for Trail Design, Construction and Maintenance Committee met numerous times during the last two years to develop an outline, discuss and develop trail standards, and critique the writing as it progressed. Individual members prepared initial drafts of selected paragraphs and sections of the handbook. Many thanks are extended to the committee members: David Aslakson, Wisconsin Department of Natural Resources Southern District Planner; Kimberly Bair, North Country Trail Association Planning Assistant; Steve Clark, Ice Age Park and Trail Foundation Northern Field Representative; Tom Gilbert, NPS—Ice Age, North Country, and Lewis and Clark National Trails Superintendent; Dennis Kulhanek, Wisconsin Department of Natural Resources Trail Planning Coordinator; Dave Lovejoy, Ice Age Park and Trail Foundation trail volunteer; and Pam Schuler, NPS—Ice Age National Scenic Trail Manager.

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## **INTRODUCTION**

When completed, the North Country NST will extend from the vicinity of Crown Point, New York, to Lake Sakakawea State Park, on the Missouri River, in North Dakota, where it joins the route of the Lewis and Clark National Historic Trail. The length of the trail is officially 3,240 miles. However, by the time it is completed the trail is expected to

exceed 4,000 miles.



Threading its way across the landscape, the North Country NST links outstanding scenic, natural, recreational, historic, and cultural areas in seven northern states. Unlike the Appalachian, Pacific Crest, and Continental Divide NSTs, which follow mountain ranges, the North Country NST journeys through a variety of environments in the northeastern and north central United States. From the grandeur of the Adirondack Mountains in New York, it meanders westward through the hardwood forests of Pennsylvania, through the countryside of Ohio and southern Michigan, along the shores of the Great Lakes, and through the glacier-carved forests, lakes, and streams of northern Wisconsin and Minnesota. Its western terminus lies in the vast plains of North Dakota.

The diversity of landscapes and scenic and historic features along the North Country NST is perhaps its most appealing quality. Large areas of publicly owned lands, such as national forests, major state parks and forests, and the Adirondack Park in New York, offer wilderness and near-wilderness experiences. Remote sections of the trail are especially enjoyable to those who value solitude. A journey through secluded areas offers outstanding scenery as well—for example, in Michigan, Pictured Rocks National Lakeshore's 42 miles of the trail follow Lake Superior's shore and features Grand Sable Dunes, Twelve Mile Beach, and colorful Cambrian sandstone cliffs. In contrast are the portions which pass through or near villages, towns, and a few large cities. These communities offer access to the trail, lodging and other accommodations, opportunities for resupply for long-distance users, and interesting cultural features.

The North Country NST exists as much for the enjoyment of the casual walker as it



does for the challenge of hikers who travel its entire length. Whether used for an afternoon of walking, a day of crosscountry skiing, or a week or month of backpacking, adventure is found along forested pathways, marshes and bogs, waterfalls, sand dunes, tallgrass prairies, old logging railroad grades, lighthouses, Revolutionary War forts, and small rural communities. From the Missouri River in North Dakota to the shore of Lake Champlain in New York, diverse features along the trail communicate how the land was formed, how it has been settled, and how it has been used and altered by man.

## **Chapter 1**

# **TRAIL HISTORY AND PHILOSOPHY**

At a time when our nation was building a bridge to the moon, others envisioned trails

crossing our continent. A need for trails and other types of recreation facilities was clearly evident in the post-war boom. The Outdoor Recreation Resources Review Commission was created to assess this need and in 1960 their survey ranked walking for pleasure as the second most popular form of recreation.

On February 8, 1965 President Lyndon Johnson delivered the Natural Beauty Message. He called for development and protection of a balanced system of trails—in the Nation's metropolitan areas as well as in the countryside—in cooperation with state and local governments and private interests. In part, the President said: "We can and should have an abundance of trails for walking, cycling, and horseback riding, in and close to our cities. In the backcountry we need to copy the great Appalachian Trail in all parts of America." In response to President Johnson's message the Secretary of the Interior directed the former Bureau of Outdoor Recreation to spearhead a nationwide trails study.

By December 1966 the study concluded with the report "Trails for America." It provided guidance and definition: "A standard of excellence in the routing, construction, maintenance, and marking consistent with each trail's character and purpose should distinguish all national scenic trails. Each should stand out in its own right as a recreation resource of superlative quality and of physical challenge." National scenic trails are to be landbased (i.e., not waterway routes) and generally are to be continuous. The report also called for federal legislation to foster the creation of a nationwide system of trails. (Earlier that year the Secretary of the Interior had submitted proposed legislation to Congress to accomplish this task.)

Of the three categories of trails proposed, the report heavily emphasized national scenic trails and the role that they should play in meeting the nation's needs for trail recreation. The Appalachian Trail was to become the first national scenic trail. Three others were also proposed: Pacific Crest, Continental Divide, and Potomac Heritage. Five other routes were identified for further study: Lewis and Clark, Oregon, Santa Fe, Natchez Trace, and North Country.

Congress spent two years working on the national trails legislation, with input from public and private interests. On October 2, 1968, President Johnson signed into law the National Trails System Act (Public Law 90-543, 90th Congress). A process was thus set in motion to create a network of national scenic and national historic trails. The call of hikers and others who sought retreat from a hectic world was answered. Opportunities to explore America along scenic pathways, at a walking pace rather than at freeway speeds, became a reality. The act established two national scenic trails—the Appalachian and the Pacific Crest—and requested studies of 14 other routes, including the North Country Trail.

The 14 original studies, and others authorized since 1968, have been completed. The North Country National Scenic Trail (NST) was designated and added to the National Trails System on March 5, 1980 (Public Law 96-199). Today, there are eight national

scenic trails in various stages of development.

As stated in the National Trails System Act:

SEC. 3. (a) The national system of trails should be composed of the following:

(2) "National Scenic Trails, established as provided in Section 5 of this Act, which will be extended trails so located as to provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass. National Scenic Trails may be located so as to represent desert, marsh, grassland, mountain, canyon, river, forest, and other areas, as well as landforms which exhibit significant characteristics of the physiographic regions of the Nation."

The trails community philosophy holds national scenic and national historic trails as the elite of the extended trails. National scenic trails are continuous and provide access to outstanding scenery and natural landscapes, and link significant natural and cultural features by means of simple pathways.

The Appalachian NST generally serves as a model or pattern for the concept of a national scenic trail. Its strong image as a footpath through primarily wooded areas sets a tone for others—the simple pathway and outstanding scenery are considered unifying elements. However, each national scenic trail has a character and identity of its own, influenced by the landscapes through which it passes.

The long-term goal for the North Country NST is to establish a continuous trail that meets the federal legislative intent. It is to be developed and managed as a **premier** hiking trail, nationally significant in its scenic and recreational qualities, and closed to motorized use. Segments which meet this intent and other criteria can be certified by the National Park Service as part of the North Country NST. (Some segments of the trail may be open to one or more non-motorized activities in addition to hiking. However, legitimate resource management activities sometimes require motorized use.)

As a "partnership park," the North Country NST should meet local needs and blend with the character of the landscape. It also needs to exhibit continuity in character, quality, and visual appeal sufficient to distinguish itself as a national scenic trail and offer an experience of higher caliber to its users.

Federal, state, local, and private landowners or managers participate in hosting, developing, and/or maintaining segments of the trail. Public land managing authorities may wish to enter into agreements with private volunteer organizations, to carry out trail development and maintenance activities, while retaining overall management control of their lands. (These organizations include the North Country Trail Association, the Finger

Lakes Trail Conference, Buckeye Trail Association, American Youth Hostel-Pittsburgh, and others). Whatever the arrangements, the national significance and integrity of the North Country NST should be clearly recognized and identified in the management objectives.

## **GENERAL ENVIRONMENTAL CONSIDERATIONS**

National scenic trails should reflect a respect for the land and serve as positive examples which demonstrate that respect. Limitations must not be exceeded in trail development. All those associated with the trail, in any way, should exercise care not to damage the very natural and cultural features that contribute to the beauty and significance of the trail. Everyone has a responsibility, to fellow human beings and to the earth, to treat the land that is temporarily in their care with great respect. By following the points listed below, the integrity of the trail's environment will be protected:

- Applicable laws, regulations, codes and standards will be adhered to.
- Trail designers and developers will accept responsibility for cultural and natural resources and insure that they are protected and/or that unavoidable impacts are mitigated.
- The trail will be designed to lay comfortably on the land. To the greatest extent possible, environmentally benign trail locations will be sought.
- Unnecessarily steep, erodible, and/or dangerous slopes will be avoided whenever possible.
- Wetlands will generally be "skirted" or avoided unless there is a very good reason to enter them—such as bringing the user into intimate contact for interpretive or educational purposes, or there is no other equally feasible trail location.
- Locations of threatened, rare or endangered plants or animals will be identified and protected.
- Trail designers and developers should be sensitive of the trails potential impact on broader habitat areas such as flyways or breeding grounds and the trail corridor should be used to enhance bio-diversity. A constant awareness of the trail's potential impacts should be maintained.

## **USER EXPERIENCE**

Protecting the trail's natural and cultural resources is of utmost importance. Secondly, trail designers and implementers must create the best possible recreational experience for the user. The trail experience is multi-faceted—it offers stimulation of the senses, a place for learning, a feeling of safety, re-creation for the soul, exercise for the body, and

overwhelming satisfaction.

The routing of the trail should stimulate the user. Variety is critical—sameness and predictability should be avoided. Around every bend, at the end of every straightaway, over the crest of every hill, through the bottomlands of every valley a new experience should be found. The sounds made by the water in a rocky brook or of a breeze sifting through a grove of white pine, the familiar smell of apple blossoms along a fence row, the relief of the sudden coolness offered by a deep maple woods on a hot, sultry day, the thrill of an unexpected panorama, or an intensely yellow field of sunflowers filtered through the branches of an oak opening, the imprint of sumac against an autumn sky, all singularly or collectively energize senses and fill memories.

The trail is a place of learning, not only about the geographies and natural communities and individual species, both human and non-human, but a place where opportunities exist for understanding life and connectedness. The trail is rich in history and pre-history, both geologically and culturally. These aspects must be present to all who use the North Country NST so that they have the opportunity to come away from their experience enriched and enlightened.

## **LOOK OF THE TRAIL**

The North Country NST should be easily recognized as a national scenic trail. It is important to maintain the aura, reputation, and national importance associated with the NST designation. The public fully expects this and deserves no less. It is important to maintain consistency throughout the entire length via standardized planning, development, implementation and maintenance. Since this is not currently feasible, the following elements will foster consistency and pride in the trail, and visitors will leave with a positive impression:

- Quality construction of the trail, parking lots, rest areas, bridges and other structures.
- Clear and consistent signage with good attention to detail.
- A well-maintained trail with regular mowing or other vegetative control.
- Timely response to problems created by storms or routine wearing out of the infrastructure.
- Regular cleanup of litter.
- Timely response to public concern on trail related problems.

## **ACCESSIBILITY**

Over the past few decades the number of persons with disabilities participating in outdoor recreation activities has increased dramatically. (It is estimated that over 43 million Americans have some type of major disability.) Recent trends in our society, influenced by federal laws, have enabled persons with disabilities to be actively involved in the mainstream of society and participate in such outdoor experiences as hiking, camping, picnicking, fishing, boating, and water-based recreation. The North Country NST offers a broad spectrum of opportunities for all people.

In this handbook, we refer to three general classes of accessibility—fully accessible, barrier free, and not accessible. Because of the length and nature of the North Country NST, there are segments that fall within each area. (Recreation Opportunity Spectrum criteria applied—see Chapter 2.)

➤ **Fully-accessible**

Portions of new trail segments that will be fully-accessible must be considered during the planning process. Opportunities are most likely to occur at trailheads—especially when a scenic overview or attraction is nearby. Other areas may occur on rail-trail segments. These may provide full accessibility since the proper standards are pre-existing. Ohio's Little Miami Scenic Park segment of the North Country NST is an example. Other fully-accessible segments occur in urban settings where the trail is available for multiple use, such as the segments that follow Battle Creek's Linear Parkway and Petoskey's River Walk.

When a trail segment is fully accessible, it is specifically designed to meet full accessibility standards. Incorporating loop trails to view select sites is suggested. A good source of accessibility standards is *Universal Access to Outdoor Recreation*, by PLAE Inc., MIG Communications, 1802 Fifth St, Berkeley, California 94710. (Further discussion about trail construction and design standards is found in Chapter 4—particularly in Figure 1.)

➤ **Barrier-free**

Barrier-free segments of the trail are more accessible than those classed as not accessible, but are less than fully-accessible portions. Parts of the North Country NST should be developed as barrier-free as is practical. Impediments such as steps, waterbars, fords, stepping stones, corduroy, and unusually narrow bridges all tend to create barriers. These types of barriers are often avoidable by choosing another trail location or construction design. Trail segments should be made barrier-free if all it takes is a little extra work or a slightly different location. However, the desired character of the trail must be retained. Standards discussed in Chapters 4 and 5 are specifically designed with the barrier-free objective in mind.

➤ **Not Accessible**

Most segments of the North Country NST are not fully-accessible or barrier-free. Existing natural elements, the remote character of the trail, the use of native material for structures, and respect for the contours of the land all serve as reasons why much of the trail will fall into the not accessible class. Steepness, rocks, and roots are just a few natural impediments. These cannot be altered or eliminated without drastic measures which are insensitive to the environment or destructive to the desired character of the trail.

## Chapter 2

# RECREATION OPPORTUNITY SPECTRUM: A VEHICLE TO TRAIL LAYOUT AND CONSTRUCTION

### BACKGROUND

The great outdoors offers a tremendous diversity of recreational opportunities. Equally diverse are the public's recreational interests and needs. From city parks to pristine wilderness, people look to the outdoors to satisfy their desires, challenge their abilities, and meet their expectations in a particular activity and setting. Recreation researchers have long recognized the importance of the relationship between expectations and settings. Many have suggested that managers should provide a range of opportunities to best serve the diversity of public expectations (Clark and Stankey 1979).

To serve as a framework for inventorying, planning, and managing recreation resources the USDA-Forest Service developed the **Recreation Opportunity Spectrum (ROS)**, in accordance with the Forest and Rangeland Renewable Resources Planning Act of 1974 (PL 93-378), amended by the National Forest Management Act of 1976 (PL 94-588). ROS allows accurate stratification and definition for classes of outdoor recreation environments. It can be applied to all lands, regardless of ownership or jurisdiction (USDA-Forest Service 1982).

Since the time of its development, ROS's use has become widespread among different agencies and groups. The following federal legislation, which requires consideration for accessibility by people with handicaps, documents acceptance for a system such as ROS: Architectural Barriers Act of 1968, Rehabilitation Act of 1973, and Americans With Disabilities Act of 1990 (ADA). The current task force working to respond to ADA requirements is basing their recommendations on the ROS. A logical step for the North Country NST's Handbook for Trail Design, Construction, and Maintenance is to follow ROS. Doing so demonstrates responsiveness to accessibility guidelines depending on the trail setting and provides a common ground for determining degree of trail development.

### ROS EXPLAINED

The current ROS of the USDA-Forest Service divides recreation settings into six broad categories which, at times, overlap—urban, rural, roaded natural, semi-primitive motorized, semi-primitive non-motorized, and primitive. In the interest of simplicity and considering the nature of the North Country NST, these are combined into four categories. The recreation settings used throughout the remainder of this handbook are:



urban, rural/roaded natural, semi-primitive, and primitive.

Many people associated with the North Country NST tend to think of and manage the trail as if it were semi-primitive throughout when, in fact, the surrounding degree of land development is inconsistent with this more restrictive level of management. At times it is difficult for volunteers and local trail managers to determine the class of an area so that the appropriate trail standards can be applied.

- **Urban** settings are characterized by substantially urbanized and modified natural environments. Although sites may still appear natural, vegetation is often manicured. Renewable resources (timber, grass, etc.) are modified and utilization practices are designed to enhance specific recreation activities. Sights and sounds of humans on-site are predominant. Large numbers of visitors can be expected, both on-site and in adjoining areas. Facilities for highly intensive motor vehicle use, parking, and mass transit are often available.

Recreation sites and opportunities are convenient and the probability of experiencing contact with individuals and groups is high. Experiencing natural environments, having challenges and risks associated with the natural environment, and using outdoor skills are relatively unimportant. Opportunities for competitive and spectator sports and for passive use of highly human-influenced parks and open spaces are common.

The areas along the North Country NST that offer a fully developed *urban* environment are limited. However, there are places where the trail passes through quaint little towns or medium to large-sized cities. The trail may follow a sidewalk or other highly developed linear parkway trail such as those portions through Lisbon (OH), Mackinaw City (MI), and Valley City (ND), or where it follows developed urban trails such as Battle Creek Linear Parkway (MI) and Petoskey Riverwalk (MI).

- **Rural/Roaded Natural** settings are characterized by a more natural appearing environment with moderate evidence of human activity. Interaction between users is low to moderate. Resource modification and utilization practices are evident but harmonious with the natural environment. Conventional motor vehicle use is common on paved, graveled, and unsurfaced roads.

An approximately equal chance of experiencing contact with other user groups and experiencing isolation from the sights and sounds of humans exists—though the chance for isolation will be much greater in roaded natural areas. Opportunities for a high degree of interaction with the natural environment are common. The challenge and risk associated with more primitive types of recreation are not very important. Practice and testing of outdoor skills are important.

Most of the North Country NST passes through this combined ROS setting. The rural setting has been combined with the roaded natural setting for simplicity because the standards for trail construction are the same in these two settings. However, there are distinct differences between the two landscapes. Generally, the typical flat, rolling, and even hilly farmland and pastoral settings are *rural*. More evidence of human activity (e.g., hay bales, plowed fields, farmhouses, and more frequent road crossings) is present. A degree of isolation is experienced when the trail passes through the isolated woodlots generally interspersed throughout the landscape. Examples of rural ROS are farmlands of southern New York, western Ohio, southern Michigan, western Minnesota, and vast open areas of North Dakota.

In contrast, *roaded natural* settings are more typical of the predominantly forested areas. Most of the national forests such as Allegheny (PA), Wayne (OH), Manistee (MI), and expansive state, county, and private forests in northern Michigan, Wisconsin, and Minnesota, fall within this setting.

- **Semi-Primitive** settings are predominantly natural environments of moderate to large size. Interaction between visitors is low but there is often evidence of other humans. The area is managed in such a way that the minimum on-site controls and restrictions present are subtle. Motor vehicle use may be prohibited in some semi-primitive areas. Timber harvesting is often present but harvest intensity and schedules are modified. Size of cut areas are smaller, timber harvest may be restricted to once per 20-25 years rather than the normal ten years, access roads are less developed and farther apart, etc.

Moderate to high probability exists for isolation from the sights and sounds of humans. Opportunities are present for independence, tranquility, closeness to nature, and self-reliance through the application of outdoor skills in a setting that offers a high degree of interaction with the natural environment.

Along the North Country NST, there are a few areas that have been formally designated by the agencies as semi-primitive, such as Red Bridge Semi-Primitive Area on the Manistee National Forest (MI). Within the national parks, the term "backcountry" essentially equates to semi-primitive. Some of the trail route through Pictured Rocks National Lakeshore (MI) is backcountry (semi-primitive). Outside of the federal lands, there may be other areas where management is less intense and more semi-primitive. Less developed portions of some state parks, such as the western portion of Itasca State Park (MN) may fall into this setting.

Generally, the semi-primitive ROS class pertains to an area or block of land that is larger than the strip of 1000-foot wide trail corridor. However, a corridor that averages 1000 feet wide and spans a significant distance along the trail could be designated as semi-primitive, particularly on federal lands. Areas of this nature

exist along the Appalachian NST, and may be the best long term solution for trail protection.

Whether or not an area is semi-primitive is often a judgement call based on factors such as acreage of undeveloped area, road density, degree of timber management, the intensity of sounds and sighting of traffic, or development observed from the trail.

The following criteria may help determine if the lands in question are managed as formally designated areas and distinguish them from the more typical forested (roaded natural) areas.

- The area has a definable boundary (roads, streams, etc.).
  - The area has at least 2,500 contiguous acres.
  - Road densities are low—averaging one mile per square mile.
  - The area is generally under one ownership or, if multi-owners, there is management commitment that the area will be managed as a unit.
  - Timber management is of low intensity and frequency. Evidence of management activities is relatively low, consisting of scattered, small, recently regenerated stands.
  - Low standard roads—often gated at the periphery of the area.
  - There is low interaction between users in a predominantly natural or natural appearing environment.
  - Boat and canoe access is generally over trails of varying lengths. Normally, boats and canoes are carried in from the periphery of the area. Some interior lakes may not have developed access.
  - Recreation is low key, light-on-the-land in nature and generally dispersed. Low impact activities such as hiking, hunting, crosscountry skiing, etc. are emphasized. Campsites are dispersed and primitive in nature. Highly developed bicycle or ORV trails are not allowed, but some areas may allow for occasional motorized use.
  - There is owner/manager commitment for this type of management.
- **Primitive** settings are characterized by an unmodified natural environment of

fairly large size. Interaction between users is low and evidence of others is minimal. The area is managed to be essentially free of man-made "improvements" and facilities. Motor vehicles and other motorized equipment are not permitted.

Experiencing isolation from sights and sounds of humans is probable. Opportunities for independence, closeness to nature, tranquility, and self-reliance through the application of outdoor skills abound and present high degrees of challenge and risk.

Only formal wilderness areas fall under this ROS setting. These are normally federally designated but can be state designated. Along the North Country NST several are encountered: High Peaks in the Adirondack Forest Preserve (NY), Rock River Canyon Wilderness on the Hiawatha National Forest (MI), McCormick Wilderness on the Ottawa National Forest (MI), Porcupine and Rainbow Lakes Wildernesses on the Chequamegon National Forest (WI), and, perhaps some day, the Boundary Waters Canoe Area Wilderness on the Superior National Forest (MN). The lowest level of trail development exists in these areas.

# Chapter 3

## TRAIL LAYOUT

### BASIC LAYOUT

The North Country National Scenic Trail shall have a treadway that is enjoyable and reasonably safe for hiking. The trail shall be designed, constructed, and maintained to minimize its impact on the natural resources of the surrounding area while taking advantage of scenic, educational, and cultural opportunities. Basic principles to consider are:

- Trail is in a visually pleasing corridor that incorporates as many scenic and other points of interest as possible—including scenic vistas.
- Trail provides for diversity of views and experiences by passing through a variety of geographic, vegetative, and cultural features.
- Trail incorporates existing trails when possible **if** they meet or can be modified to meet the basic standards of a national scenic trail.
- Trail provides connections to other trails, recreation facilities, parks, resource and cultural areas, communities, etc.
- Trail requires minimum maintenance while providing ecological variety.
- Trail avoids the more developed portions of rural areas.
- Trail reflects the mood and atmosphere of the area it traverses.
- Trail has local landowner support.
- Trail has the necessary support facilities.
- Trail makes maximum use of public lands and other large holdings—provided that other desirable trail qualities are present. Public land should not be used solely because it is there. For instance, if it is entirely wetland there is probably a better location.

### DESIGN CONSIDERATIONS: USER

#### USE POLICY

The 1982 comprehensive management plan for the trail specifies the following:

All segments of the North Country NST shall be open to travel by foot, i.e., hiking and backpacking. Other nonmotorized uses, including bicycling, horseback riding, cross-country skiing, snowshoeing, and jogging, may be permitted on a given segment according to the desires and policies of the managing authority responsible for the segment.

Multiple use of the trail for activities other than hiking, those which can take place during the same season and/or those which take place during other seasons of the year, should be considered. A managing authority responsible for a relatively short segment of the trail should consider the uses permitted on adjacent segments of the trail and consult with the responsible managing authority when considering additional uses on its own segment.

Uses other than hiking should be permitted only if the activity will not cause significant deterioration of the trail and surrounding environment and the activity can be safely accommodated, i.e., the trail is constructed according to accepted standards for that activity.

Some have misinterpreted the first two statements to mean that the NPS encourages as much multiple use as possible. Instead, the policies convey the fact that the North Country NST, like the Appalachian NST, is primarily intended to be a hiking trail. However, recognizing that the route of the North Country NST incorporates many existing trails, and the fact that the trail will only exist through the voluntary cooperation of others who see the trail as a help to meeting their own objectives, the decision of permitting other non-motorized uses was left to local managing authorities.

**Nevertheless, the policy cautions against permitting other uses which might physically damage trail resources or which the trail was not designed to safely accommodate**, including safety of the primary users—hikers. The mention of bicycling as a non-motorized activity which might be permitted by a local managing authority was primarily intended to accommodate existing or future rail-trail segments. It was not intended to specifically permit or encourage bicycle use on a section anticipated as, in most cases, a simple footpath. Bicycle use of simple footpath segments was not originally contemplated by the management policies presented in the plan. The mentioning of horse use was intended to allow the North Country NST to utilize segments already developed that permitted horse use, such as the Shore-to-Shore Riding and Hiking Trail (MI), some rail-trail segments, and a few other hardened trail segments. It was not intended to encourage horse use on the typical woods and field footpath segments, most of which lie on sandy, organic, or occasionally wet soil which cannot handle horse traffic without significant trail

tread and resource deterioration.

The following paragraphs reflect the NPS perspective, as overall administrator of the trail on bicycle and horse use. These statements are based on the policies in the 1982 plan and the intent of those policies as explained above.

We believe that bicycling is best accommodated as a use on the North Country NST on rail-trail segments and on other short sections of hardened surface (1) specifically designed for wheeled vehicles, where bikes will not damage natural or trail resources, (2) that are parts of previously established multiple use trails that become part of the North Country Trail route, (3) where bicycles can be physically restricted to the designated section, and (4) where bicycle use will not adversely affect the recreational experience of hikers. These conditions generally are not found on the typical, single-track, forested and rural segments of the North Country Trail.

We believe that horse use is best accommodated on the North Country NST on those segments of trail which have been specifically designed and hardened to withstand such use. These conditions generally are not found on the typical, single-track, forested and rural segments of the North Country Trail. Additionally, horse use is perhaps an acceptable use on most trail segments within the prairies and grasslands of North Dakota and western Minnesota, where the character of the North Country NST changes from primarily a wooded experience to primarily a prairie (big sky) experience, passing through many miles of farms, ranches, and grasslands. Here, the flavor of the trail is more "western" than "eastern" and the dryer soils are more forgiving of horse traffic than in wetter, forested areas. In these areas, there may also be opportunities to establish parallel hiking and horse trails, such as along the McCluskey and New Rockford Canals—horses on the old access road and hikers on a foot trail within the boundary of the canal right-of-way.

The types of use that are allowed on a segment of trail have major implications for the level of maintenance required and the amount of resource impact that must be mitigated. Foot traffic causes the least impact on the environment. Bicycles cause greater impact, and horses even more.

Investigation of sections where bicycle use is considerable shows that bicyclists tend to ride around waterbars, thus widening the trail. Loosening of the trailtread occurs on uphill and downhill portions, accelerating erosion. Trail tread in sandy soils is churned up even on level stretches, making it unpleasant for hikers. Horses cause either muddy conditions or loose sandy conditions—depending on the soils that are present. Both resultant trail conditions degrade

hiker experience because they make for unpleasant, difficult hiking. Horses also damage trail structures (e.g., steps, waterbars, etc.) built to withstand the needs of hikers. When horses cannot cross small bridges over streams or wetlands, they wade through these sensitive riparian areas causing degradation to the water resource.

In regard to motorized use, the National Trails System Act is very clear. It defines national scenic trails as non-motorized trails. Section 7(c) of the Act (16 U.S.C. 1246(c)) limits the types of uses by stating, "the use of motorized vehicles by the general public along any national scenic trail shall be prohibited ...." This restriction prohibits the use of trailbikes, snowmobiles, ATV's, etc. on the trail. It also prevents the recognition of marked routes of public roadways as the official route of the trail. Following short sections (less than one mile) of public road is permissible in some circumstances, such as when it is necessary to use a public vehicular bridge to cross a major river.

## OPEN SPACE

It is important to route the trail so that occasional portions are in the open. This provides stimulating experiences: the user can see the sky, feel the sun and gain a contrast to the woodland experience. It enables the user to view the landform and natural features from a variety of perspectives—both from long distances and more intimate ones. Some routing might be through the middle of a large open space while some might be along the edge. Other routings might take the user into the middle of that same space, then over into the woodland for a short distance, and then back out into the same open space along the edge.

It is desirable that the trail provides a representative view of the area through which it passes. In North Dakota, western Minnesota, and the agricultural portions of the other states, high percentages of the landscape surrounding the trail are, or were, historically open. In these areas sizeable portions of the trail should pass through or next to open areas. In order to provide variety, wooded areas should be sought. In other areas such as southern Ohio, northern Michigan, and Wisconsin, the landscape is almost entirely forested. In these forested landscapes, the trail should be predominantly forested and incidental openings and old fields sought for variety.

While variety is important, wooded areas are most desirable for hikers and volunteers performing trail maintenance due to the heat intensity incurred in open areas. The amount of maintenance required in open areas is greater because the trail must be mowed several times during the growing season. Trail maintenance through wooded areas is less intense and longer lasting. In agricultural areas, farmers are not likely to want the trail to pass through the middle of their cultivated fields. Greater acceptance can be achieved by routing it along fence rows or through woodlots. Benefits of open areas can be provided by routing the



trail close enough to large openings to see into them, yet staying far enough in the woods so as to not interfere with farming practices and also avoid the vigorous growth of annuals and perennials found in the opening's sunlight. If a public trail corridor becomes reality, a vegetative management plan that considers both historical and current vegetation will be prepared.

## TERRAIN

It is important that users experience the full array of terrain found along the corridor. The route should be in continuous transition. Portions of the trail should take the user along ridge tops, while at other times the trail should be routed through more intimate valleys. The lengths of upland, lowland, etc. should also vary and should be influenced by the natural landform available. The user should also have some experiences left to the imagination. Every hilltop should not be climbed, nor every valley be entered. When designing the route, care should be taken to avoid overly steep grades where environmental damage is likely. It is important to go with the flow of the landforms. Those too steep or erodible should be avoided.

## GLACIAL FEATURES

Glacial features are encountered along parts of the North Country NST. Users should be brought in contact with glacial features because they add interest, variety, and offer opportunities for interpretation. The user should be able to experience glacial features from a variety of perspectives incorporated in the trail layout (e.g., enabling the user to traverse the entire length of one esker, and then parallel another esker from a sufficient distance to allow for good viewing of the landform). The integrity of glacial features such as kames should be protected. Trail development on kames should be avoided because the soils are too fragile and the slopes are generally too steep. Trails should never compromise the integrity of outstanding glacial features. Variety is important—too much routing along the same types of features can result in redundancy and boredom.

## DESIGN CONSIDERATIONS - ENVIRONMENTAL

Use is light in many locations along the North Country NST, and even poorly designed trail may cause little impact on soils, water, sensitive plants and animals. However, in high-use areas environmental impact is of more immediate concern. Heavy use can destroy the soil structure of the trail and lead to soil erosion, with possible siltation of streams and eventual fish habitat destruction. It can also turn wet areas into muddy ones, trample plants, etc. One of the early signs of damage is an increased prominence of small stones in the trail tread because the surrounding soil particles have been washed away. As time passes, the stones (paving) in the trail become progressively larger in size as water carries away trail material—soil particles first, then sand and stones. If the situation is not corrected small rivulets appear, followed by ditches and

gullies.

The trail must be designed to withstand heavy use without destroying the environment. It must cross the land without causing soil erosion, path widening, vegetative trampling, or spoiling the natural qualities of the area. Once the trail is designed, it must be built properly to achieve environmental safeguards and maintainability of the trail.

Sustainability and durability are key considerations for all North Country NST efforts. To design and build trail correctly at the onset is a wise investment and more economical than to repair or relocate the trail once damage occurs. Facilities which were constructed by the Civilian Conservation Corps (CCC) in the early 1940's are still used. Many of these (including picnic shelters, lodges, trails, stone work, etc.) are as sound today as they were when they were first built because the CCC used quality construction techniques and materials. Trail construction efforts should pattern the quality CCC examples. Using rocks for trail retaining walls requires more effort and expertise than using logs, but the result is a much more durable wall. Sidehill trail construction is more labor intensive than constructing trail directly up the slope but it is much less erodible and sound.

On state or federal lands, an environmental assessment (EA) or similar document which meets the intent of the National Environmental Policy Act (NEPA) is prepared prior to selecting the trail route or doing actual construction. NEPA compliance is also required on projects that use federal funds or when federal officials are doing the planning. The process involves specialists who understand environmental impacts and how to minimize them. Ideally, the environmental assessment process is adopted prior to action anywhere along the trail. When this cannot be done, trail advocates should take positive steps to minimize potential impacts. The scope of this book does not provide a detailed description of all techniques used to protect the environment. However, the general guidelines listed below should be followed (this list is not all-inclusive):

- Design considerations for trail layout fall into one of two major categories: User and Environmental. These may often be in conflict with each other. When conflict exists, err should be on the side of the environment rather than on the side of user convenience or desire.
- When locating or relocating a trail, key places where the trail must pass should first be identified. These could be campgrounds or campsites, scenic view areas, the best stream crossing sites, historical sites, connection spots with other trails, water sources, etc. Next, these locations should be marked on a topographic map or aerial photo. The best way to connect these features, considering slope, soils, and other factors should then be determined .
- Local experts and agency officials should be contacted to learn what fragile soils, threatened or sensitive species, cultural and historical resources, and other opportunities or concerns occur in the corridor. This consultation process should

determine if an EA is necessary and minimize passing through any areas of concern.

- In order to avoid damage or destruction of historic and prehistoric resources, the project must comply with the requirements of the National Historic Preservation Act and the Archeological Resources Protection Act when it occurs on state or federal lands **or** when it involves federal money or personnel. Project approval regarding historical and archeological concerns usually rests with the State Historic Preservation Office (SHPO).

A cultural resource survey conducted by trained archaeologists is usually required prior to any earth-disturbing activity. In some states an agreement is reached with the SHPO to wait until the initial trail is established before doing the survey, because:

- trail construction normally involves a minimum of earth disturbance, most construction is done by hand tools, and
- slight adjustments to the actual alignment are made during the actual construction (to avoid trees, boulders, etc.).

However, whenever more than minimal earth disturbance is contemplated (e.g., when constructing a parking lot, digging footings for bridge abutments, etc.), an archeological survey and SHPO approval is required **prior** to project initiation.

- Quality of trail construction plays a significant role regarding impact on the environment. When a trail is located and constructed so that it requires minimal maintenance, there is less present and future environmental impact. Considerations such as adherence to slope, proper drainage, etc. are important factors.
- The standards for the trail, trail structures, and support structures detailed in Chapters 4, 5, and 6 are designed to protect the environment as well as the user. They should be followed closely to ensure environmental protection.

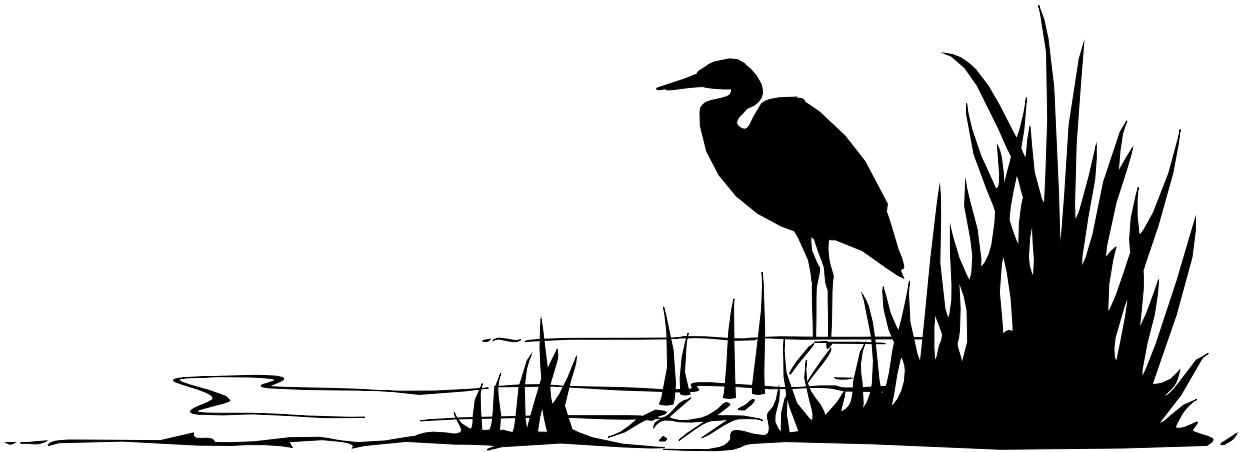
## SOILS

When locating the trail, choices must be made between routes that provide more or less soil (trail) stability. The key to locating a trail that is stable and minimizes environmental damage is to find the most stable terrain connecting the key trail points (see Design Considerations - Environmental section). Areas of heavy, saturated soils or shallow soils should be avoided whenever possible. When the trail must pass through these areas, puncheon or boardwalk should be used (see next section for more detail). Deterioration of the trail from erosion and saturation can be dramatically reduced by designing and constructing the trail

on stable terrain.

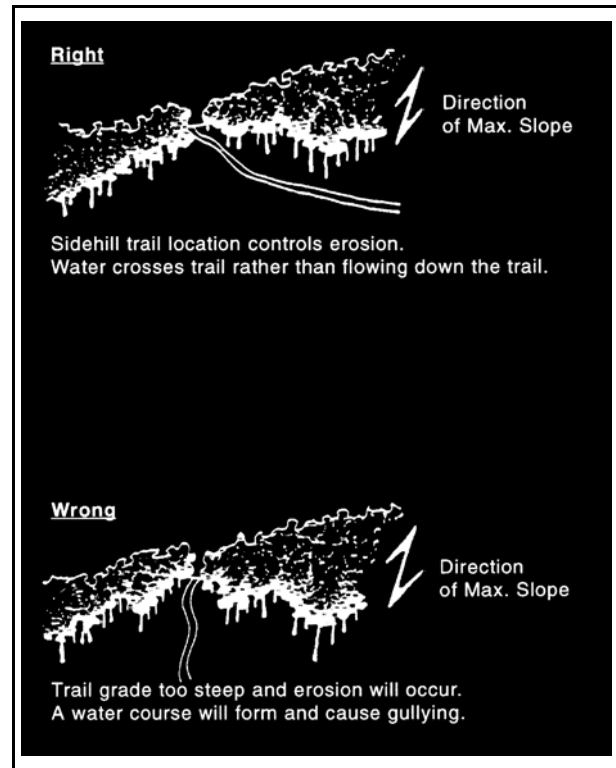
## WETLANDS

Wetlands are the transition between open water and dry, upland terrain. The North Country NST passes through wetlands in all seven states—extensively in the Great Lakes region. Defined as "areas with shallow standing water or seasonal to year-long saturated soils," they can be subdivided into a number of categories such as sedge meadow, shallow marsh, deep marsh, shrub swamp, wooded swamp, bog, etc. Wetlands are fragile sites and often contain an abundance of sensitive species such as orchids, pitcher plants, and other unusual plants and animals. Passing through wetlands presents obvious problems—soil stability, damage to sensitive species, the possibility of changing the natural water levels, etc. For these reasons, wetlands are usually avoided. However, wetlands can provide variety and interest to the trail, and it may be desirable or even unavoidable to incorporate them on occasion. When it is desirable to cross a wetland, do so at its narrowest point and incorporate an appropriate trail structure such as puncheon or boardwalk. Most states require permits for altering a wetland. Appropriate officials should be contacted prior to any wetland activities.



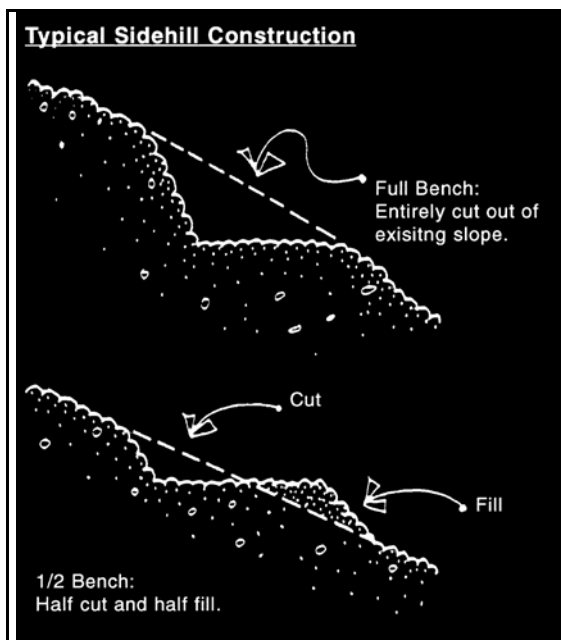
## SLOPE LOCATIONS

Another key factor in determining the stability of a trail is slope location. The best way to prevent erosion in hilly terrain is to construct the trail on sidehill locations and maintain moderate grades (see Chapter 4). Even on moderate slopes, the trail should never go straight up the slope of the hill. Wending the trail across the face of the hill, gradually gaining altitude by using sidehill trail construction and broad, sweeping switchbacks, provides for a more stable trail because surface water does not run down the trail. Instead, it crosses the trail and disperses on the downhill side. Sidehill construction makes it easier to maintain moderate grades, further reducing erosion.



Sidehill construction requires more skill and initial work. However, in the long run, it provides the most stable trail, less environmental damage, and less work. When employing sidehill trail

construction, it is important to do the job properly. Poorly constructed sidehill trail can cause difficult hiking and sore ankles if the hiker has to walk with one leg higher than the other. The trail tread must be excavated so that it is nearly level with only a slight outward pitch to allow water to cross the trail and continue downhill. This requires builders to construct either half- or full-benched trail tread. A half-benched tread (sometimes called balanced tread construction) means that half of the tread is on solid excavation and half is on the fill. Full-bench tread construction means that the entire tread is on a solid excavated area.



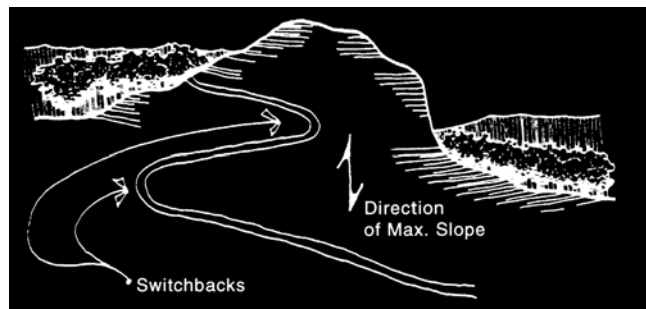
Whenever possible, a full-bench tread should be constructed because it is more stable. The excavated soil

is allowed to "waste" below the trail and does not become part of the trail tread. Other labor-intensive techniques, such as rock or log cribbing, may be required in steeper areas.

Maintaining a moderate grade when laying out a trail through hilly terrain can be challenging. Taking the time to locate and flag the proposed route is a time consuming but important first step. Topographic maps should be used to locate key points that the trail must pass. These points could include vistas, campsites, stream crossings, etc. Once key points are identified, a line should be flagged to connect them, while attempting to stay within the slope guidelines shown in Figure 1 (Chapter 4). This flag line may have to be moved several times before the best route is located. This step should not be abandoned in discouragement. It can save future maintenance headaches. (See Appendix 4 regarding eye level survey techniques.)

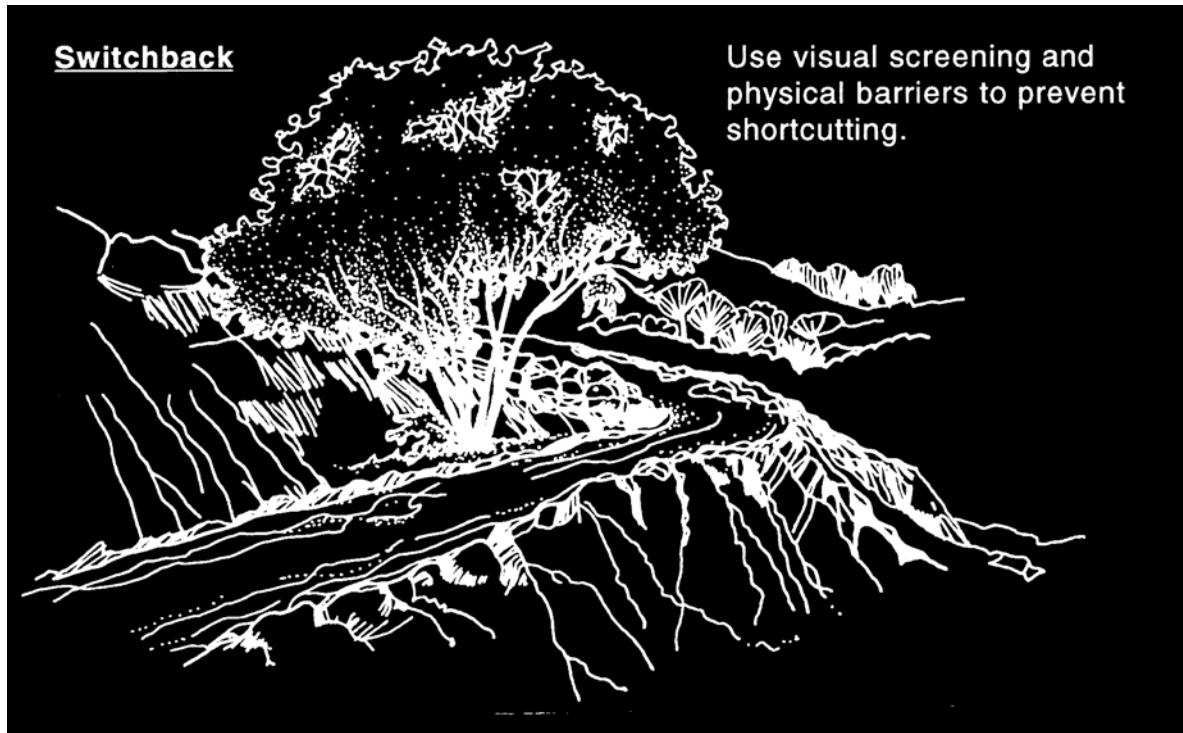
Several existing trails were laid out without considering slope guidelines. As sections of these trails become problem areas, it may be easier to relocate sections rather than repair the poor location.

Switchbacks are one method that can be used to maintain the grade of the trail while gaining the required elevation—especially when there is limited working area. Switchbacks should generally be minimized in number and frequency because they are difficult to construct and maintain, lengthen the trail, are boring to walk, are difficult to drain, and are often shortcut by hikers—thus increasing erosion problems. A trail with switchback layout is enhanced by increasing the length of trail between switchbacks into grand sweeps and by varying the length and placement of adjacent switchback legs.



Proper switchback construction requires specific skills (details can be found in Appendix 1). The manner in which switchbacks are placed on the land is critical to creating a maintenance-free section. They must provide the easiest, most attractive route for ascending and descending so that hikers do not shortcut them. Turns should be flat. This requires careful location or additional construction of cut and fill sections or retaining walls. On sideslopes of less than 20 percent, the switchback should be treated as any other section of the trail by following a long, radius curve. If the centerline grade is steeper than desired, the radius should be shortened and a conventional 8-foot radius switchback should be built, with the upper and lower legs meeting at the radius point. Excavation should start along the upper slope line of the upper leg and be carried down to

grade at the radius point before starting the lower leg. To provide proper drainage, the upper leg should be cut well beyond the radius point, then shaped and the turn area completed. Whenever possible, the frequency and visibility of turns should be limited to avoid shortcutting. The layout should vary.



Switchback legs should be situated so that they are not visible from each other. Turns should be looped around large boulders or fallen trees, or where vegetation obstructs the view of an adjoining leg. If this is not possible, rock or log barriers should be placed between the upper and lower legs of the switchback. To prevent cross-cutting inside the switchback, 15 to 30 feet of barrier should be installed (placed back from the turning point).

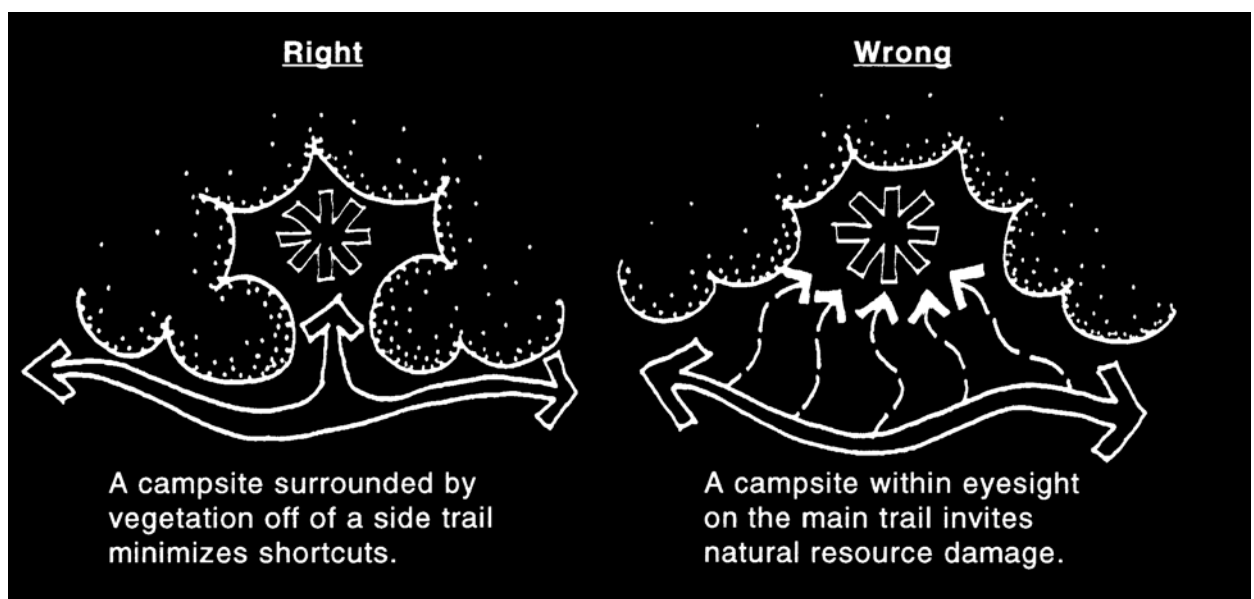
## SPUR TRAILS

These are dead end trails that provide access to facilities or features near the main trail such as viewpoints, campsites or shelters, and water. Spur trails can also lead from a trailhead to the main trail. They can enhance the recreation experience by allowing visitors to see interesting features that the main trail misses, and help control overuse of sensitive sites. They force the hiker to make a conscious choice to leave the most direct (main trail) route and double back to it before continuing their journey.

In almost all cases, it is desirable to locate campsites and shelters on a spur trail—out of sight of the main trail. This eliminates widening and trampling of the

approaches to the campsite and provides for less disturbance to campers already using the site. When a campsite/shelter is located within sight of the main trail, hikers gradually widen the approach to it and enlarge the campsite itself by taking shortcuts and destroying the vegetation. If the hiker can see or hear others using a campsite/shelter and the terrain is open, he/she will shortcut.

To minimize shortcutting, trail alignments and junction locations that make the established trail the easiest, shortest, and most logical route, should be used. An established campsite/shelter (especially in heavy use areas) should be at least 200 feet off the main trail unless rugged terrain or ownership patterns limit this distance. Less used sites can be a shorter distance away depending on the circumstances.

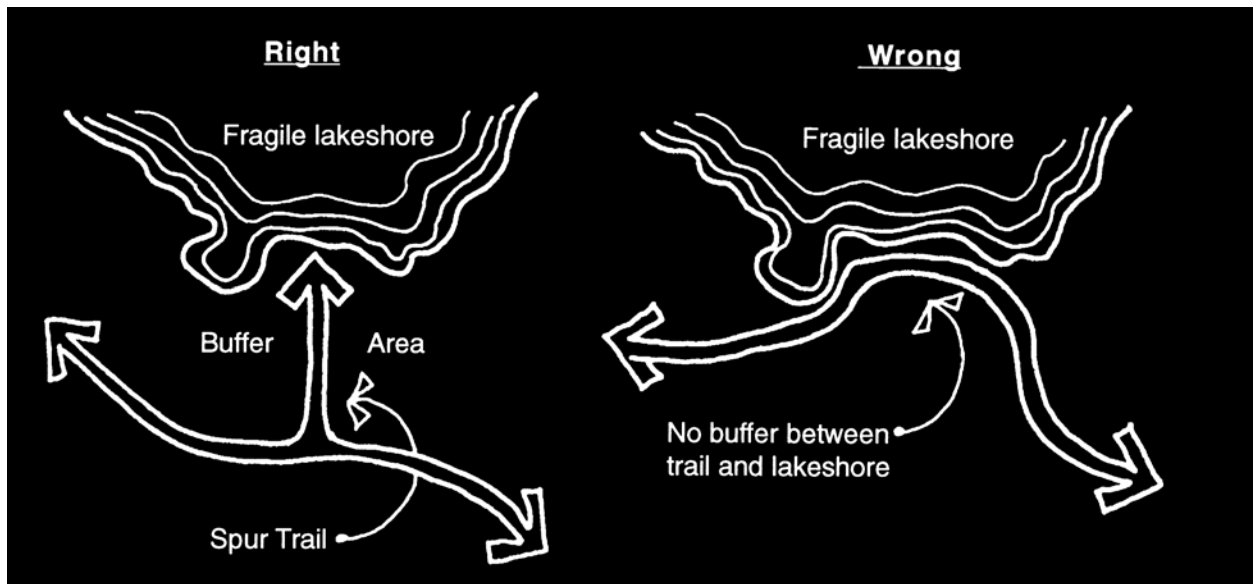


Drinking water sources, pond and lake shores, fragile escarpment edges, and other areas containing fragile plants or unstable soils are often protected by bypassing the feature. However, if this is done, much of the interest of the trail will be missed and hikers will establish their own impromptu trails to reach the site anyway—often causing more impact.

The best compromise is to limit access to the least sensitive part of the attraction via a spur trail. This reduces the impact by limiting the access to a single point and potentially reducing the number of users. If an existing main trail is causing undue impact to a sensitive area, relocating the trail away from the feature and providing access via a spur trail is a consideration. The main trail should be kept far enough away from the attraction so the sensitive area is not obvious and impromptu trails do not develop. A new location should be selected where views of the feature will be available from the main trail to satisfy the user, further



reducing the number that follow the spur trail.



In order to provide variety and interest along the main trail, spur trails are not always recommended. The main trail can be routed past features that can withstand more impact. Reduction of feature overuse should be tried first by better trail construction, moving the trail to a more stable terrain nearby, or educating users. A balance between the environment and recreation is the goal. However, when questionable conditions occur, the environment should have priority.

# Chapter 4

## STANDARDS FOR TRAIL CONSTRUCTION

The objective of trail standards is to ensure a consistent look without compromising local initiative, a high standard of quality without over-building, a basic level of safety without removing all risk, accessible portions without compromising the character of the trail, and environmental and resource protection. Standards were developed to meet these objectives without compromising the character of the trail or imposing undue hardship upon those who maintain the trail. Whenever it is possible to retain the foot-trail-through-the-woods character, but still allow a very determined, mobility-impaired individual to get through simply by increasing trail width by an inch or two, it should be done. There are case-by-case exceptions, but every effort should be made to conform to the trail standards when building or rebuilding trail.

The North Country NST passes through a variety of recreation settings (ROS). Therefore, the trail should not and will not look exactly the same from end to end. It is not appropriate to build the trail to urban standards in a semi-primitive setting, nor vice versa. For this reason all standards are based on the ROS setting. Consistency is achieved through signing, blaze color, and the fact that a segment occurring in a particular ROS setting (roaded natural, semi-primitive, etc.) will look similar to a segment in another area that is in the same ROS setting.

Figure 1 on page 33 summarizes the desired trail design standards. If a trail segment is significantly below these standards, it should be gradually improved. However, if no attempt is made to rectify the situation, it may be decertified or closed. Whenever a portion is being reconstructed or receiving heavy maintenance, attempts should be made to bring it up to standard. Although these guidelines do not prevent a particular trail segment from exceeding desired standards, it should not be assumed that doing so is always desirable. Routinely exceeding the standards will adversely impact the character of the trail and hiker experience.

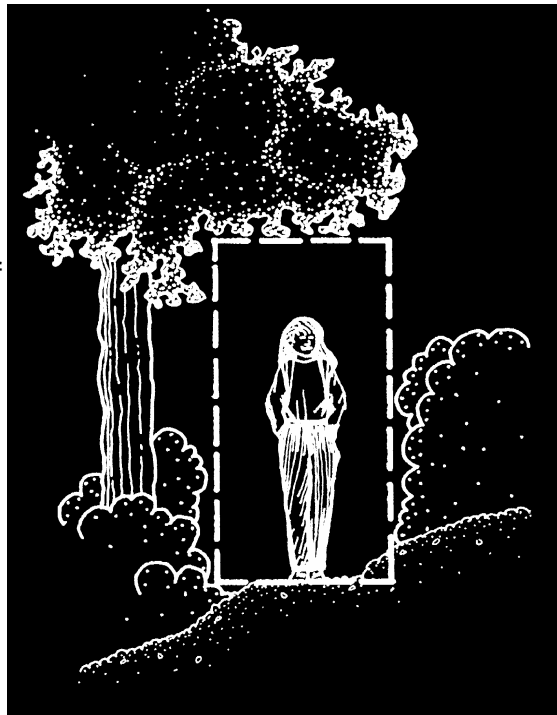
Exceeding trail standards in selected locations may be appropriate, such as the trail segment in the Little Miami Scenic Trail (OH)—a converted rail-trail that accommodates multiple use and is designed as fully-accessible. (See Figure 1.)

### TREAD WIDTH

Tread width refers to the actual walking surface of the trail—whether native soil, grass, or surfaced. Initial tread should be constructed or smoothed to this standard. In less used areas the bare tread may gradually transform into a tread that needs to be mowed. This is acceptable as long as the basic underlying, smooth structure is still in place.

## CLEARING WIDTH

Clearing width is the area kept free of brush, limbs, briars, tall grass, weeds, and other obstructions which would slap against the hiker or their pack, or soak them following a rain or heavy dew. In heavily wooded areas, the clearing width is normally maintained simply by pruning limbs. Here, the area between the edge of the tread and the edge of the clearing is normally leaf litter or short herbaceous plants. While four feet is the average standard width, some variation is allowed and encouraged—it is visually appealing and often more sensitive to adjoining natural resources. In wooded areas there are occasions when it is desirable to narrow the clearing width in order to route the trail between two large, visually interesting trees. Generally, the trail winds between existing medium to large size trees, and is created by cutting only smaller trees and saplings.



Narrowing the clearing width below the desired standard is done only for reasons of aesthetics—not merely to reduce trail construction/maintenance efforts. When the trail is crossing fields or prairies, it is suggested that as a minimum, the entire desired clearing width should be mowed. It may be desirable to widen the mowing to create a variety of gentle clearing undulations. Some of these may highlight a particularly bright clump of wild flowers or a well-developed flowering shrub such as a hawthorn or dogwood.

In selected wooded areas (especially near roads) a common practice is to reduce the clearing width for a short distance (25 to 100 feet) to discourage unauthorized use by ATVs, horses, etc. (When this is done accessibility may be compromised).

Figure 1 (on page 33) shows the clearing width on each side of the tread. On a hiking segment in a rural area, the total clearing width would be the 24-inch tread plus 12 inches on each side for a total of 48 inches (the commonly accepted 4-foot clearing window).

## CLEARING HEIGHT

The trail should be cleared to a height of 8 feet (10 feet within Wisconsin DNR properties). At this height, branches that could snag on a tall hiker's extended pack or

attachments, such as a fishing rod, are removed. Branches that could restrict the trail when weighted with rain or snow are also removed. If the trail is in an area of deep snow and it receives winter use, clearing may have to be higher. Whatever the reason for a higher clearing height, an overhead canopy of branches should remain to slow the growth of grasses and shrubs that thrive in sunlight.

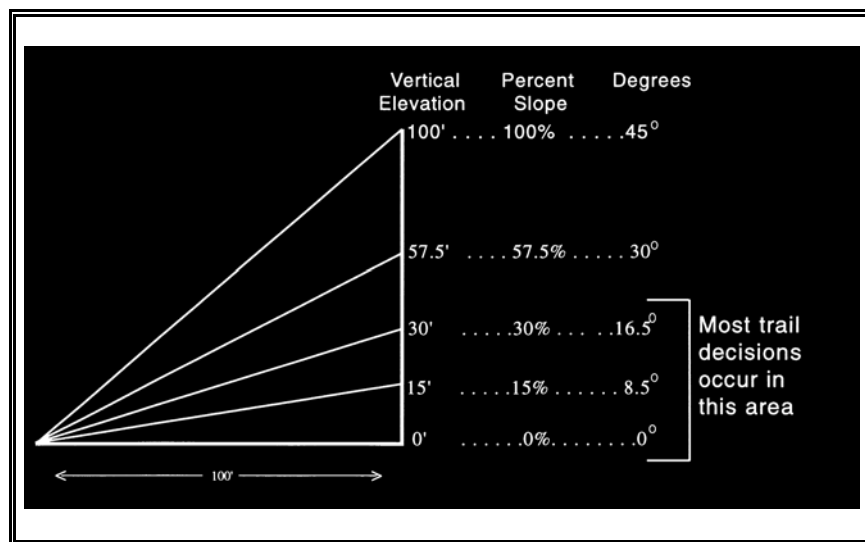
### **SLOPE (SUSTAINED)**

The slope (grade) of the trail may be the key factor contributing to tread stability. Trail grades must be moderate to promote a stable, maintainable tread and a more pleasant hike. The trail should be designed to traverse a hilly area with gentle changes in grade. Grade and slope are interchangeable terms.

To avoid erosion, the slope should normally be less than 10%—even in steep terrain. Grades less than 7% in all soils are ideal, but in sandy soils are almost a necessity to prevent erosion. In flatter areas, trail should be located so that there is some grade to provide for proper drainage. A grade should undulate gently to provide natural drainage and to eliminate monotonous level stretches and long, steep grades that are tiring to trail users.

Slope can be calculated in degrees, but is normally calculated in percent by dividing the vertical distance by the horizontal distance and multiplying by 100 (10

feet of rise/100 feet of horizontal distance X 100 = 10%). An easier, more accurate way to determine slope is through the use of a tool, about the size of a compass, called a clinometer. By sighting through the clinometer, the percent of slope can be read.



### **SLOPE (MAXIMUM)**

While reasonable efforts should be made to construct the trail using the sustained slope guidelines, there are occasions where doing so is impossible. Because of terrain obstructions, such as cliffs, it may be necessary to use a short, steep segment to regain access to more moderate slopes. In these instances, the maximum slope guidelines should be used and additional erosion control measures incorporated. Sections of trail exceeding the sustained grade standards should normally be less than 100 feet.

In some areas, it may be necessary to go up a very steep slope for a short distance. In these areas, steps may be necessary but should be considered as a last resort due to the barrier they impose on many people.

## **CROSS SLOPE**

Cross slope is a consideration when constructing trail across the face of a hill (sidehill trail). Some degree of cross slope, or out slope, is desirable so that water moving down the face of the hill continues across the trail. A cupped trail or a trail that slopes back into the hill collects water and is undesirable. However, the cross slope should not exceed the percentages shown in Figure 1. Cross slopes greater than those shown make walking on the trail uncomfortable and serve as an impediment to mobility-impaired individuals. A 5% cross slope on a 24-inch tread amounts to a drop of 1.2 inches.

## **OTHER STANDARDS FOR ACCESSIBLE TRAIL**

These standards apply only when a trail segment is designed to be fully accessible. Figure 1 specifies the maximum distance between passing and rest areas. Each passing space should be 60" × 60". At intervals specified, rest areas are built adjacent to passing areas and may include a bench or other facilities.

## **TRAIL SURFACE**

In most cases, the native material found during trail construction will be satisfactory for surfacing the trail. However, if the material consists of large amounts of topsoil or organic matter, it should be set aside for later use as a cover and planting surface for exposed sub-soil.

Figure 1 shows a range of surfaces that are acceptable in the various ROS settings. While several options are shown for rural/roaded natural areas, the strong preference is for native surfacing. The Accessible Surface Standards apply only when a trail segment is designed to be fully accessible. Wood chips should not be used to correct wetness problems. They only add more organic material to the site and compound the problem when they rot. Also, wood chips can not be used on steeper slopes as they do not stay in place. They are acceptable on relatively level sections of trail to smooth an otherwise rough tread surface and to help retard weed infestation and wear of the natural surface.

**FIGURE 1. NORTH COUNTRY NATIONAL SCENIC TRAIL  
TRAIL CONSTRUCTION DESIGN STANDARDS**

Standards (desired)	ROS Class			
	Urban	Rural and Roaded Natural	Semiprimitive	Primitive
<u>Tread Width</u> Hiking Segments Accessible Segments	48" 60"	24" 36"	18" 28"	*
<u>Clearing Width</u> (each side of tread))	24"	12" (WIDNR-24")	12"	*
<u>Clearing Height</u> (min.)	10'	8' (WIDNR-10')	8'	*
<u>Slope(max.sustained)</u> Hiking Segments Accessible Segments	10% 5%	10% 8%	15% 12%	*
<u>Slope (max.)</u> Hiking Segments Accessible Segments	15% for 100' 8% for 30'	20% for 100' 10% for 50'	30% for 100' 10% for 50'	*
<u>Cross Slope (max)</u>	3%	5%	8%	*
<u>Other Accessible Segment Standards</u> Passing Spot Int.-max Rest Area Interval-max	N/A 1200'	600' 1200'	1200' 1/2 mile	N/A N/A
<u>Surfaces</u>	Asphalt. Concrete. Stabilized- aggregate. Screening(1). Wood Chip. Sod.	Native. Wood Chip(2). Stabilized-aggregate. Screening(1).	Native	Native
<u>Accessible Surfaces</u>	Asphalt. Concrete. Stabilized- aggregate.	Asphalt. Stabilized-aggregate.	Native. Stabilized- aggregate.	Native

\*In Primitive ROS (wilderness), human impacts and changes to the scenery are meant to be less obtrusive—when entering a wilderness area, one accepts greater personal risk. Trails in primitive areas lay "light-on-the-land." Because of this, no hard standards have been established. Generally, the tread is more faint, the grade varies depending on the terrain, etc. However, it is still important to consider trail design standards which protect the environment. Because trails in wilderness areas may receive less frequent maintenance, designing a trail that requires little maintenance is of utmost importance.

- (1) Limestone screenings include the fines.
- (2) Not in wet areas—adds to the problem.

# Chapter 5

## TRAIL STRUCTURES

Trail structures discussed in this chapter refer to those which are necessary for trail passage. Trail structures normally respond to user safety and environmental protection issues—not user convenience issues. In this context, almost all structures refer to passing through or across wet areas or open water such as bridges, puncheon, or boardwalks. Steps and stiles apply to passage of topographical or human-caused barriers. Standards for trail structures are summarized in Figure 2 (page 50).

Trail structures are necessary to meet the demands of various situations. However, those required to correct a problem also require a major commitment in terms of both initial and subsequent costs, time, and maintenance. Therefore, it is recommended that alternatives be considered. The most simple technique to correct a problem should be tried and utilized for a year or two to see if it works. If the simple solution proves unworthy, a decision can always be made to incorporate a structure. For instance, digging a small drainage ditch to drain a mudhole may be tried first. It may take a year or so for a long-existing mudhole to firm up. If it does, the solution was easy, quick, and inexpensive. If it doesn't, the complexity of the solution is elevated. Perhaps a few well-placed, flat stepping stones or a small section of puncheon or turnpike will do the trick. Another alternative to a structure is to re-route the trail. Even this seemingly major action may be the best long-term solution. However, there are situations when the decision to construct a structure is obvious and can be made immediately.

Trail structures should be built of quality, long-lasting material and designed to harmonize with the surrounding environment. Minor structures such as puncheon, turnpike, retaining walls, culverts, and small bridges can be built of suitable native material, if it is available. Rock—as used by the CCC—makes a longer lasting retaining wall, bridge sill, or water bar than does wood. Certain species of wood are more durable than others. The most durable material should be used, and time taken to work with it will pay off in the long run. When native materials are used, the source site should be left in as natural a state as possible.

Whenever possible, the trail route should be located to avoid areas with seasonal or year-long water problems. Trail construction in these areas is both difficult and expensive. In addition, permits are usually required for crossing officially defined wetlands or navigable streams. Where wet areas are unavoidable, structural improvements should be used to provide a dry, stable treadway for the North Country NST. Regarding wet areas of the trail, a "dry boot" philosophy is the goal, except within ROS primitive areas and during inclement weather or heavy dew. Hikers should not normally have to wade through streams or saturated wetland areas—this is not only unpleasant and dangerous, but potentially damaging to

the environment.

## BOARDWALKS

Boardwalks are employed to cross areas that have deeper water than can be crossed by puncheon. Typical locations are where the trail has to cross a cattail area, deep marsh, or other water body that has little fluctuation in its level and flow. The distinction between a boardwalk and puncheon is that the surface of a boardwalk is constructed of boards that are perpendicular to the direction of the trail, and the entire structure is supported by posts driven or anchored into the bottom of the wetland, similar to a dock.

Boardwalks do not rest on sill logs.

Another distinction is that puncheon is normally less than a foot above the surrounding wetland, while a boardwalk can be 2 to 3 feet above the water—like an elongated dock. Wetland crossing permits will almost surely be required.

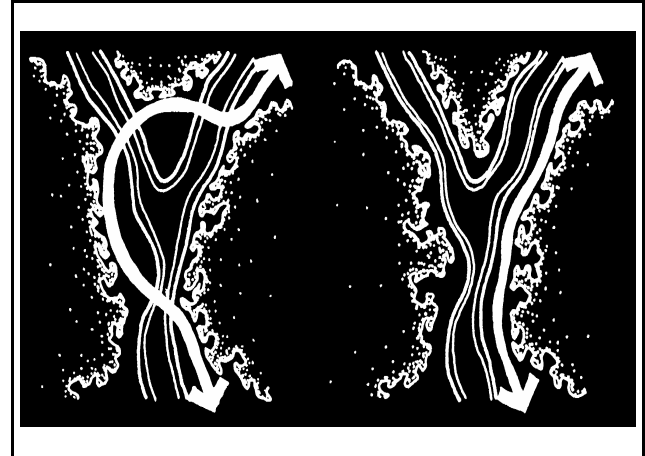


Boardwalks are normally made of treated material. If they cross areas of fluctuating water levels, the support posts need to be driven deep into the substrate or anchored in concrete to prevent the boardwalk from lifting or warping. Since boardwalks are a major, long-term investment, and they often cross moderately deep water, the standards specified in Figure 2 are designed as an accommodation to safety and provide for wheelchair passage. A kickplate is required to reduce the chance of falling into the water when the boardwalk is slippery due to rain, frost, or ice. The kickplate also makes the boardwalk safer for wheelchairs. The width should be a minimum of 28 inches between the kickplates. Depending on the situation and the desires of the local manager, handrails are optional. (The formula shown in footnote 1 in Figure 2 should not be attempted. It does not apply because, in this handbook, a boardwalk is not considered a bridge).

## BRIDGES



Bridges are structures for crossing permanent and seasonal streams, dry ravines or gorges, and other obstacles in a safe, environmentally sensitive manner. The use of bridges to cross streams and ravines is strongly encouraged. On the other hand, constructing and maintaining a bridge is a major, long-term investment. Bridges are expensive to build, require regular inspections, and need frequent maintenance. All stream crossings should be reviewed to determine whether or not they are really necessary. Perhaps the trail was originally laid out to cross a



stream several times because it simplified construction. Evaluating the route may show that the number of crossings can be reduced. The possibilities should be studied carefully. Relocation may often be safer and less expensive than building a bridge. Each state has its own rules regarding bridge specifications and placement. It is necessary to work closely with responsible state agencies to ensure that all specifications are met and all the required permits obtained. Plenty of lead time is critical as this can be a lengthy process, depending on the stream being crossed and the complexity of the bridge.

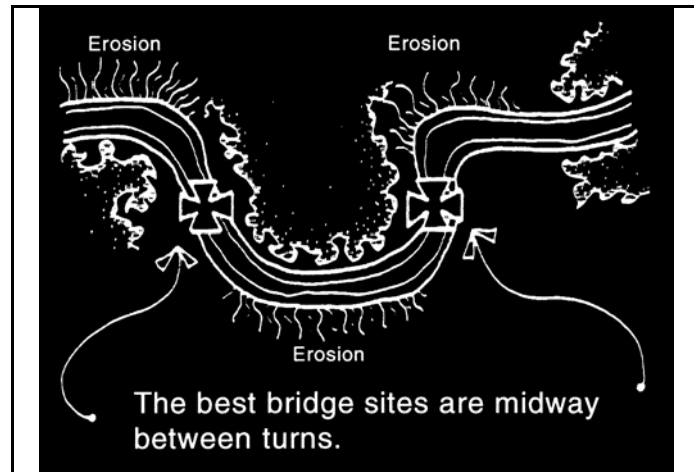
It should be noted that some of the bridge standards in Figure 2 (width, railing requirements, etc.) do not apply to other water-related structures such as puncheons or boardwalks and there is no clear way to distinguish between bridges and other structures. A bridge is defined as something that spans a definable stream, ravine, or other obstacle, rather than resting on a long series of sills (puncheon) or posts (boardwalk). However, a bridge can have one or more piers. Common sense should be used when defining a bridge. A bridge should not be confused with puncheon or boardwalks when looking at the standards shown in Figure 2. In this context, "bridge" is not the correct name for something crossing a widespread area of wet soils or general surface water such as that found in a wetland. However, a wetland often has a stream flowing through it that requires a bridge. In such a situation, there may be a boardwalk across much of the wetland with a bridge across the stream in the middle.

Safety of the user is a primary reason for building any bridge and a consideration in the design of the bridge itself. Not only can it be unsafe to ford a stream (see section on fords), but descending steep, often slippery stream or ravine embankments can also be dangerous because of slipping and falling hazards. The steeply descending trail is a source of erosion that can degrade stream quality. For these reasons, a bridge is often appropriate when crossing even small streams or dry ravines. Certainly, it provides for less wear and tear on the legs of a pack-laden hiker.

When a bridge is necessary, alternative locations should be carefully evaluated. The

clearance of the bridge must provide for passage of high water, ice, and debris. Only bridges built with an adequate opening to accommodate such flood waters will survive. Generally, the highest reasonable height above the stream should be sought. A location that is narrow and has a high bank or ledge to anchor the ends of the bridge is best. Such a site can eliminate the need to construct cribs.

The volume of flood water and the bridge height needed can be estimated from careful observation and research. However, observation will probably only yield information on recent high water levels, not historical peak flows. Determining peak flows is a complicated process which considers specific elements such as the size of the watershed and historic precipitation—it is best done by someone trained in this area. In addition to safety



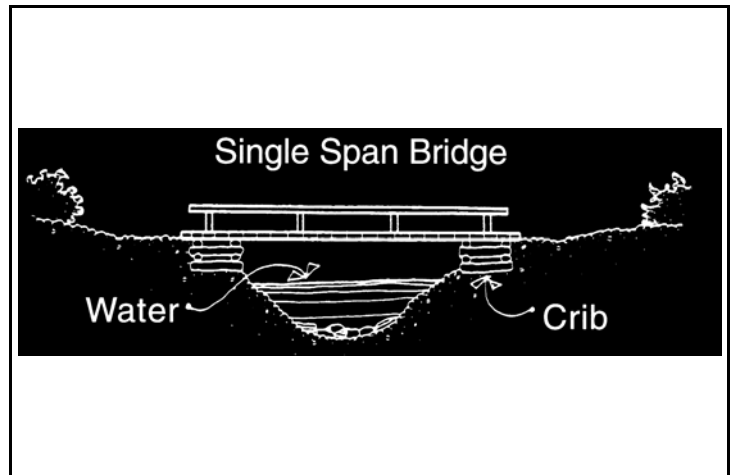
considerations, this is one reason why the standards shown in Figure 2 call for engineering design on all bridges that are greater than 25 feet in length or higher than five feet. Assistance should be sought from agency partners, the Natural Resources Conservation Service (formerly the Soil Conservation Service), private engineering consultants, or other qualified personnel.

Whenever possible, the entire wet area should be spanned, or ramps used to get onto an elevated bridge. This eliminates the need for steps which are an accessibility barrier. As seen in the section on steps and perrons (later in this chapter) it is recommended that steps be minimized.

**Type of bridge** - There are many different bridge designs that ensure adequate public safety at stream crossings while maintaining the appropriate ROS setting of the trail. It is not the purpose of this handbook to undermine the traditional creativity of volunteers. Rather, it is expected that creativity will be channeled to design a bridge which meets the standards shown in Figure 2. All bridges should incorporate high quality materials and workmanship. There are three major categories of bridge designs—(1) puncheon type, (2) single span stringer bridges, and (3) multi-span bridges, suspension bridges, and other more complicated designs. The height and span of the bridge, plus the applicable ROS setting, determines what kind of bridge structure to build and what materials to use. (Several bridge designs are included in Appendix 1.) When the span is less than 10 feet and the bridge is not subject to flooding, a simple puncheon type bridge may suffice.

Crossings over 10 feet wide can often be crossed with a single-span bridge. These normally require the construction of cribs or fills on each bank, two to three solid timber or laminated support beams, a board deck, etc. Depending on the circumstances and dangers, a railing may be required.

In areas where the span becomes too long for a single span bridge, the design becomes more complicated. Multi-span bridges with a support structure(s) in the middle of the stream, or a suspension bridge, may be necessary.



**Bridge width** - Because bridges provide passage over a trail barrier, and because they are long-term investments requiring substantial commitment of funds, they should not become a barrier in and of themselves. If a mobility-impaired individual has successfully negotiated a segment of trail, the bridge should not be the bottleneck that is impossible to cross because of its width. Therefore, the minimum clearance width should be as shown in Figure 2. These widths were selected to minimally accommodate accessibility, even on trail segments that are not specifically designed to be barrier-free or fully accessible.

**Bridge railings** - A railing is often necessary for visitor safety and to increase the comfort level of users. Considerations such as depth or swiftness of water, height above the ground or water, length and width of the bridge, desired experience level, and other factors help determine when railings are necessary, and whether one or two railings are installed. Weather related factors such as ice, snow, frost, rain, and the increased chance of slipping and falling from the bridge need to be considered. Besides the element of danger, another consideration is that there are some trail users who are simply frightened of walking across what they consider to be a narrow structure. Some agencies will insist that railings be placed on every bridge because of their concern for liability. These and other factors argue for railings.

In some situations railings may actually increase the risk of someone falling. This train of thought follows that if a railing is present, a user will linger longer on the bridge rather than hurrying across to solid ground, thus increasing their exposure to the hazard. Another consideration is that railings are often considered to be the weak point of a bridge. Depending on the method used to fasten the railings

to the bridge deck, trapped moisture can lead to decay of the railing support or the main beam of the bridge. If this goes undetected, it could lead to a railing giving way if someone leaned on it. In situations where there is little danger, the inclusion of railings can change the character of the trail and the user experience—it is not desirable to over-build. These and other factors argue against railings.

Everyone's perception of dangers is different—one person may say a railing is a definite need, another person may say it is unnecessary. To establish a degree of uniformity along the North Country NST and to provide some direction to trail volunteers and others, use of the bridge railing formula shown in Figure 2 is recommended. Revisions may be necessary as experience dictates. Bridge builders may decide to be more strict than the formula and install railings anyway, depending on the hazards.

**Bridge rail height** - When railings are necessary, 42 inches is the standard height adopted by a number of state and federal agencies. It is a common height that provides for a fair degree of visitor safety and therefore is the accepted standard for the North Country NST.

**Bridge engineering design** - Bridges must be designed to provide for visitor safety, withstand snow loads, accommodate flood waters, etc. A bridge is a major investment and it is common sense to seek engineering consultation for certain bridges—those greater than 25 feet in length or greater than 5 feet in height (above the water level or the bottom of the dry ravine). All trail bridges should be designed to bear a load that meets or exceeds current management standards for architectural design and engineering of pedestrian structures. To achieve this standard, qualified personnel, such as engineers, should review the elements of proposed designs (stringer size, strength, snowload, peak flows, etc.) and approve them prior to installation. The National Park Service, the Forest Service, and other agencies generally require that an engineer either develop or review all bridge plans. While it is specified that engineering design or review is required only on certain bridges, agency partners should be consulted because they may have more stringent standards. The intent of this policy is to ensure professional review of proposed bridges or bridge reconstructions. Before providing funding assistance, such as Challenge Cost Share proposals, on any bridge project where the standards call for engineering design, a project sponsor must provide adequate details showing the need for the bridge, a map showing the location, and construction drawings that show the bridge's span, height, materials used, and other details. If qualified engineering expertise is available, either through an agency partner or trail club member, their review and documentation is suggested when seeking NPS approval or funding.

**Bridge clearance above navigable waters** - Navigability is defined by the individual state. At least one of the trail states bases their determination on a

historical use of the stream—can a log be floated down the stream? Generally, if a canoe can be floated down the stream during spring flows, it is considered to be navigable. The trail states require the issuance of a permit before spanning a navigable stream and will specify the clearance heights. Generally, this is 5 feet above the water surface, but it is recommended that this be confirmed with state agencies and necessary permits be obtained.

**Bridge inspection and maintenance** - Bridges require periodic maintenance to insure their stability and safety. Debris should be cleaned from cribbings, bolts checked and tightened, sills inspected for rot, etc. Bridges should be carefully checked by trail maintainers and all major bridges (>25 feet long or > 5 feet high) should be inspected by qualified personnel at least once every three years. This inspection should be documented. In addition, trail club members should be alert to the development of hazardous conditions between inspections, and should also routinely inspect smaller bridges.

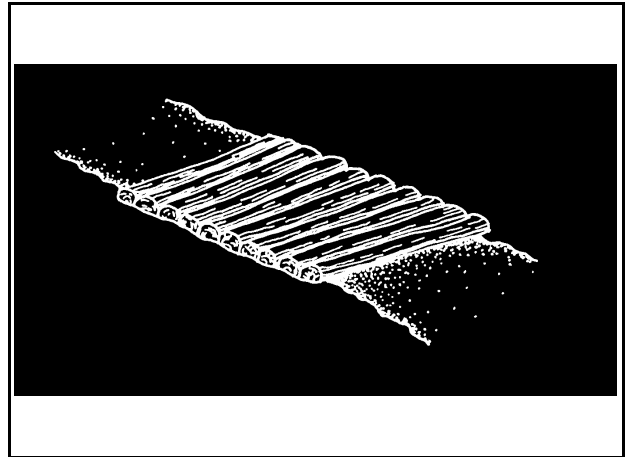
## **CAUSEWAY OR TURNPIKE**

When enough rock, gravel, or earthen fill is available, the trail tread can be elevated through poorly drained areas by using a causeway or turnpike. This permanently hardens the tread and is a useful technique when soils are poorly drained but do not have standing water as found in a wetland. A typical causeway is built by first defining the width of the trail tread with parallel rows of rocks or logs. The defining rows also serve to retain the fill. When in place, the filling process should begin with medium-sized stones that will allow water to pass under the causeway. A fill of small stones, gravel, soil, or a mixture of materials should be continued to create the elevated causeway and ensure a smooth walking surface. The surface should be rounded 2 inches above the elevation of the defining logs or rocks to provide better drainage and to allow for settling.

A ditch can be dug parallel to and on both sides of the causeway to improve drainage. This variation is often called a turnpike. The material excavated from the ditches can be used to help fill the causeway.

## **CORDUROY**

Corduroy construction is basically a primitive type of puncheon. It consists of laying native logs perpendicular to the trail to harden it through areas of unstable or saturated soil. If corduroy is left exposed, it provides uneven, slippery footing that is uncomfortable for the hiker, and does not convey the impression of a well designed trail. Consequently, on the North Country NST, exposed corduroy is not acceptable, except as a temporary measure until a more permanent solution can be installed—and then only in areas that are not defined as wetlands. Puncheon is a better alternative.



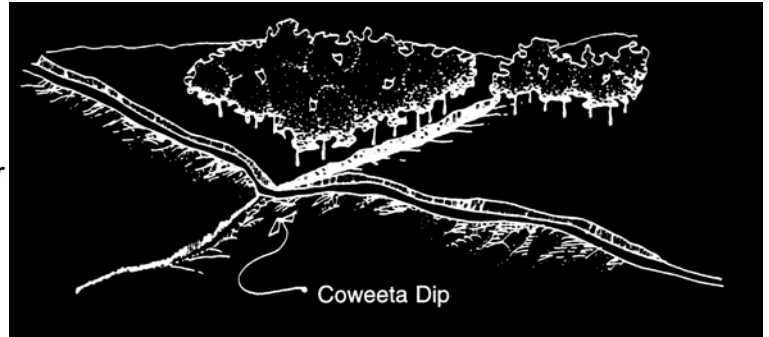
In some parts of the Lake States, roads were often constructed across boggy areas using corduroy and covered with soil. The log base provided the required degree of flotation and the soil cover provided the smooth driving (in this case walking) surface and kept the logs from rotting. While still employed to some extent, geotextile material now takes the place of the logs. The use of this technique can provide a suitable trail structure, but the ramifications of its use should be carefully considered. A corduroy bog structure can change the natural flow of water through the wetland, change the water level, kill the upstream vegetation, or change the species composition. Covered corduroy involves considerable modification to the site and is not recommended in the types of soils/sites where corduroy is typically employed. Wetland permits are usually required. Other alternatives such as puncheon or boardwalks are less intrusive on the site and easier to construct.

## COWEETA DIPS

Coweeta Dips, or grade dips, are created when a short section of the trail is built with a grade slightly opposite to the prevailing grade. These are one of the most effective drainage techniques in trail construction, blend aesthetically into the landscape, and are almost maintenance free. They are cost-effective in controlling erosion and reduce the monotony of long, sustained grades.

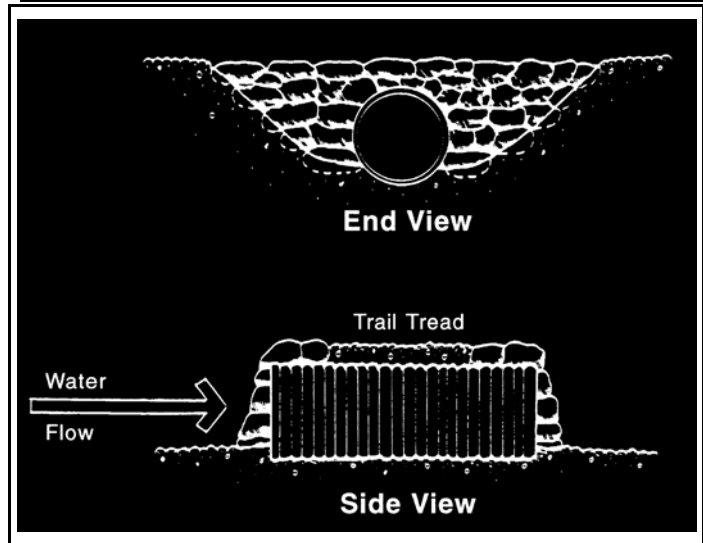
Dips are most effective when built as part of the original trail construction, but can be used when relocating short problem areas if the terrain allows. On an ascending trail segment the trail should level every 50 to 100 feet followed by about 15 feet of **slightly** descending trail before continuing upward. This almost imperceptible descent creates a dip (low point) and forces water coming down the trail to drain off—less than a foot of elevation is lost for the hiker. The dip itself requires no construction other than careful building of the sidehill trail to establish the dip's alignment.

Since a place is needed to discharge the water, Coweeta Dips usually are best suited on sidehill trails. Coweeta Dips take advantage of the natural roll and drainage of the landscape. They should be positioned naturally into the terrain for maximum function without being obvious. Spacing should be varied to make the trail more interesting.



## CULVERTS

Culverts are used to pass water under the trail. They are an excellent alternative to a small bridge and can be used to accommodate water flow from either spring runoff or small permanent streams. Culverts are most effective in natural drainage places where minimum excavation is required. They also can be used in flat areas to provide equalizing, cross-drainage under causeway or turnpike sections, and reduce the damming effect.



Culverts may be more cost effective and less obtrusive than a bridge. They are easier to install in most instances. They can be constructed of rock, logs, corrugated metal, corrugated plastic, or other suitable material. As stream size increases, engineering advice should be sought to insure that the culvert is sized to accommodate peak flows. If the stream is permanent or is a designated trout stream, permits should be obtained.

While culvert installation sounds simple, there are some basic principles which must be followed for the installation to last. Culverts should be installed with a gentle downstream gradient of around 2% and should be properly bedded to ensure continued performance. If metal or plastic pipes are used, a minimum of 6 inches of soil (free of sharp rocks) is recommended for pipe cover. Pipe diameters less than 12 inches may present frequent cleaning problems.

## FORDS

Due to safety concerns, legal implications, and the "dry boot" philosophy, fords should not be used. Fording on new sections of trail should not be accepted and any fords on existing trail segments should be bridged as soon as funding is available. A possible

exception to this policy is across very small streams in ROS Primitive areas.

Drownings have occurred when hikers attempted to wade seemingly innocuous streams during high water periods. One unfortunate incident involved an experienced hiker (who had logged over 26,000 trail miles) who attempted to wade what by all appearances was a 25-foot-wide, shallow, Arkansas stream. The creek was not over knee deep and was not cold. However, it was fast flowing and treacherous enough to knock the hiker off his feet and sweep him to his death.

Because of the locations of the North Country NST and long distances through the Lake States, water is more than a short-term springtime concern. Water does not dissipate as quickly as in hillier areas, and lasts well into the summer. Permanent solutions (e.g., bridges) are more appropriate for these areas than fording.

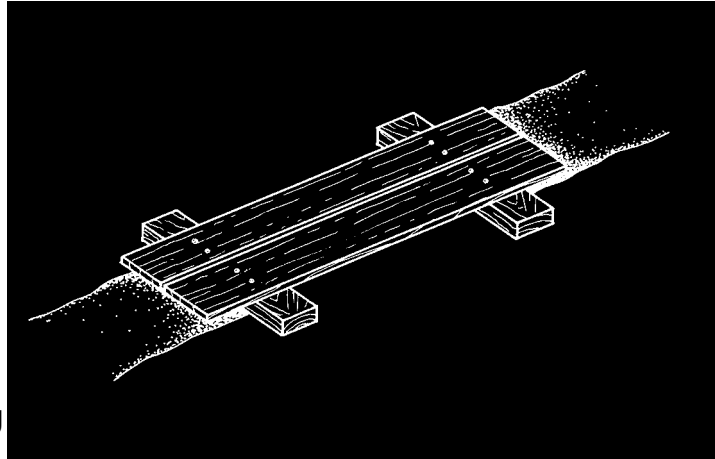
## **PUNCHEON**

Puncheon is an effective way to cross some types of bogs, shallow marshes, and wooded wetlands. It uses sawed, treated lumber or native logs to elevate the trail tread above wet areas that are not feasible to drain. It provides a hardened surface that lasts for many years depending on the material used. The walking surface is parallel to the direction of the trail, and the support structures (sills) rest directly on the ground. The use of puncheon is strongly recommended since a wet, muddy trail and the damage caused from hiking directly through wetlands are undesirable. A puncheon bridge can range from as little as 10 feet to hundreds of feet long for crossing a swamp.

Puncheon can be constructed using either native or milled materials and often is a combination of the two. Most typically, the sill logs are made of long lasting native material (such as cedar, tamarack, locust, etc.) and the walking surface is made of heavy, treated planks. The determination of the material depends on a number of factors—the distance from an access point, ability to haul materials to the site, the availability of native materials, the skills available for the difficult job of hewing native puncheon, the desired length of time between replacement, and the ROS setting.



Once the route through a wetland is chosen and the trail is cleared, the first step is to obtain and place the sill logs. These rest directly on the wet soil and vary in length from about 3 feet to 5 or 6 feet depending on the amount of support provided by the wetland. The stringers (walking surface) are then placed on top of the sill logs and secured in place with large spikes. If native logs are used as stringers, some notching and fitting has to be done so they do not rock on the sills. Puncheon is normally built in 8 to 10-foot sections with no more than 6 inches from the end of one section to the beginning of the next. When treated planks are used, the ends typically rest directly on the sill logs—often without gaps between the sections. In this situation, one sill is located directly at the junction between two sets of planks. However, because planks have more flex, a center sill may be needed. In order to achieve the puncheon width specified in Figure 2, two 2"× 8" or 2" × 10" planks will be needed.

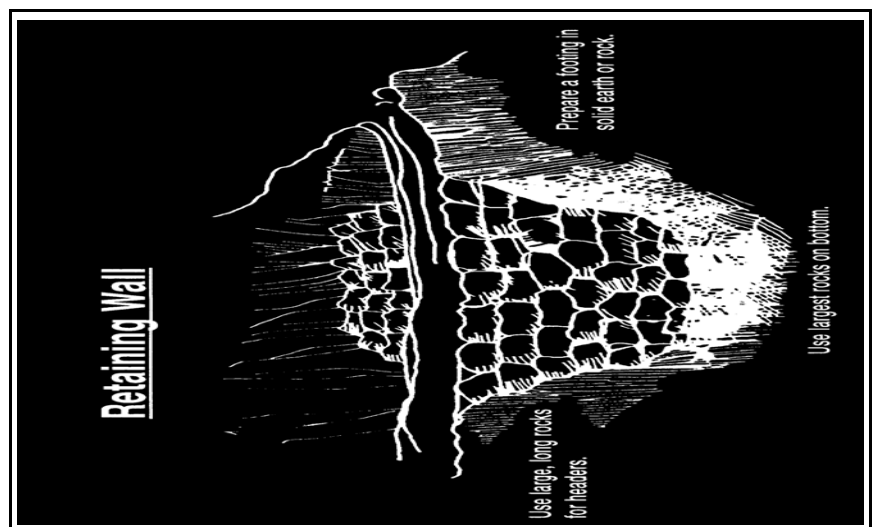


The trail tread at both ends of the puncheon must be solid and dry; otherwise, the stepping-off point may become soft and muddy, eventually requiring the construction of an extra section of puncheon. It may be necessary to place several flat stepping stones at the ends of the puncheon to help the soil withstand the impact of hikers.

In areas subject to flooding, such as along streams or near beaver activity, puncheon is not a good choice because it can float out of position or even completely away. In these areas, relocating the trail or using boardwalk should be considered (provided it is protected from spring floods along streams).

## RETAINING WALLS

Retaining walls are structures of stone or wood designed to stabilize the trail base on steeper side slopes. They are time consuming to construct but may be necessary to prevent soil slide or slump when sidehill trails are crossing the face of a slope that exceeds 40% to 50%. Retaining walls are a long lasting investment—many constructed by the CCC in the 1930's are still functional today.



Sound, durable rocks with good, angular (rather than rounded) bearing surfaces are the preferred material because of their locking ability and durability. Native decay-resistant or treated logs can also be used if rock is not available. The foundation must rest on solid earth or rock to obtain a rigid, safe retaining wall. The thickness of a rock retaining wall at the base should be at least one half the height of the wall or a minimum of 2 feet if the vertical height is less than 5 feet. The outer face of the wall should have an inward slope of at least 2 to 3 inches for every foot of height. Drainage is required around, beneath, or through the wall so that water will not accumulate behind it and build up pressure which could destroy the wall.

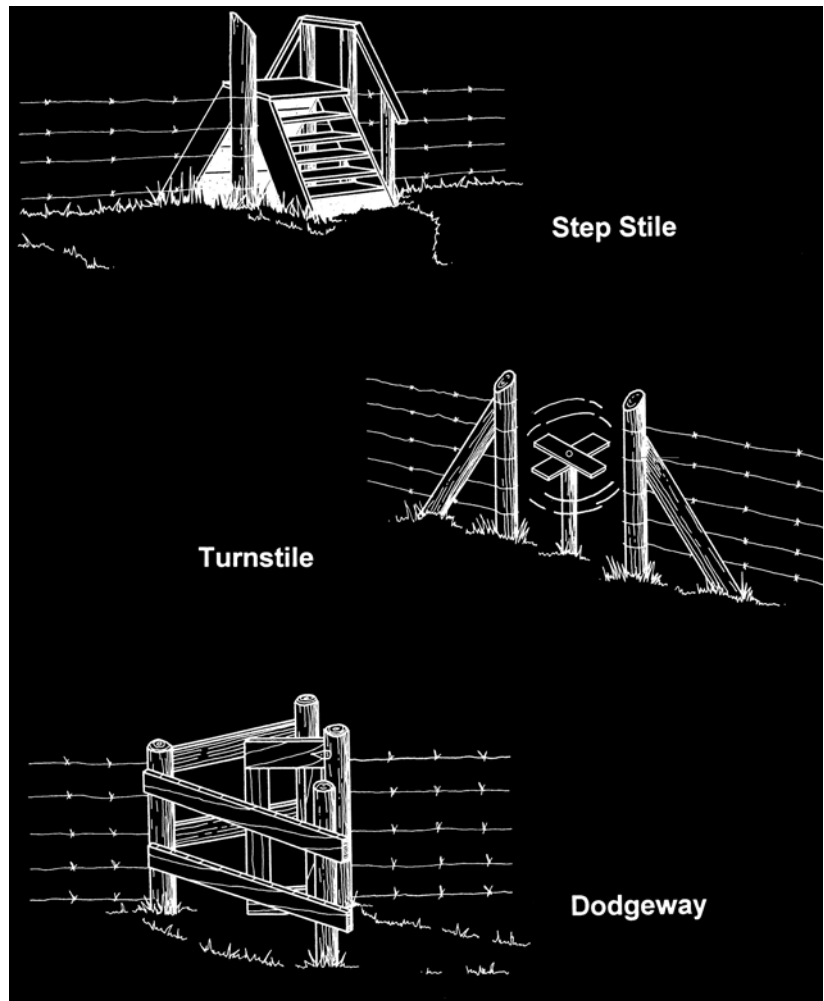
## **STEPPING STONES**

Stepping stones can effectively harden the trail tread across short wet areas or mud-holes. Suitable large, flat stones that are firmly set so that they do not rock—which may otherwise cause hikers to lose their balance—may be the least expensive, most durable solution to a problem area. Cut rounds of log should not be used as substitute stepping stones as they become slippery with moss and are a safety hazard. They are also less durable and convey the impression of poorly designed trail.

Generally, stepping stones should not be used to cross streams unless the stream is very small and requires only a few stones. Then, they can be used only where the bank is solid and will not become eroded. On navigable streams, or streams with a fish population, stepping stones are opposed by many state agencies because they can create an artificial barrier to water flow or modify the fish habitat. Stepping stones also pose a barrier to accessibility and can become slick with moss and water—a falling hazard for all persons. This application should be avoided whenever practical and considered a temporary solution until a bridge can be installed.

## STILES

Pastures and other agricultural fields often occur on private lands and are separated by fences. These are primarily in rural/roaded natural ROS settings but also can occur in other areas. While it is desirable to minimize as many fence crossings as possible, they are impossible to avoid altogether. Whenever a fence must be crossed, it should be equipped with a stile to facilitate hiker passage and eliminate fence damage. Gates could serve the same purpose as a stile but they are more expensive to construct and maintain. There is also the likelihood that a gate may be left open allowing livestock to escape. The landowner should always be consulted to ensure that the stile is located and constructed to meet their needs. In areas where user conflicts exist, a stile can effectively serve as a barrier to unauthorized use by horses, bicycles, and ORVs.



There are a wide variety of stiles in use, including step stiles, turnstiles, and dodgeways or pass-throughs. The stile of choice is often determined by the area's cultural traditions.

## STEPS AND PERRONS

Steps and perrons (elongated steps—more like a series of connected platforms) should be avoided. In most cases, proper trail layout can alleviate the need for steps. These structures are difficult and time consuming to properly construct and often create an unnecessary impediment. They make an otherwise difficult but accessible section of trail inaccessible. Even persons who are generally considered to be ambulatory, but who may have knee or hip problems, find steps more difficult to negotiate than gradual inclines.

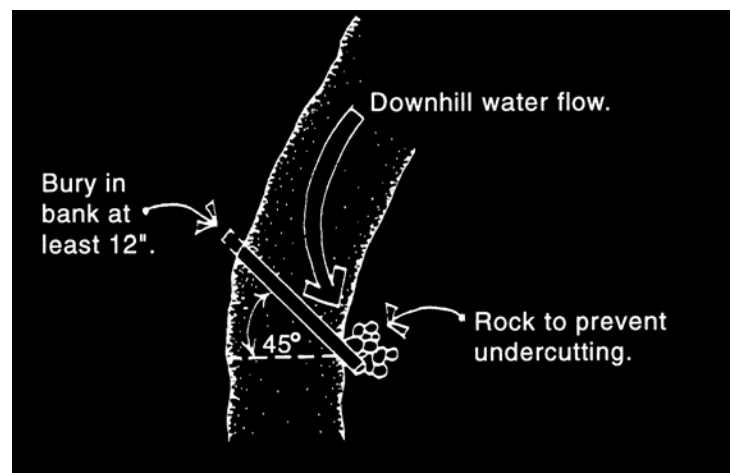
In some cases there may be unavoidable topographical barriers—such as where an

escarpment separates two moderately sloped grades—or land ownership patterns that restrict where the trail can be built, forcing it to traverse a hill at a much steeper-than-desirable grade. In these types of circumstances, steps may be the only alternative.

Step construction details are not provided (other than Appendix 1) since use of steps is limited. Local experts and a copy of the Appalachian Trail Conference's *Trail Design, Construction, and Maintenance* by Birchard and Proudman are good references.

## WATERBARS

Waterbars are rock or log structures that divert water off of the trail. Other innovative materials which offer more accessibility, such as rubber belting, have been used on some trails in recent years. However, these innovations take away from the natural character of the trail. On the North Country NST, traditional rock or logs are to be used—except on those segments of trail designed as fully-accessible. During new trail construction, the use of waterbars can be minimized through careful attention to the grade of the trail and use of Coweeta dips. On older trails, or where it is necessary to use steeper trail grades, waterbars may be the only effective way to divert water from the trail. Where water flowing down the trail is anticipated, it is better to install waterbars immediately than to wait for erosion to occur.



### ➤ Spacing

Waterbars keep the speed, volume, and distance water travels down the trail to a minimum. The actual number and spacing of waterbars depends on the amount of water entering the trail, the steepness of slope, the construction of the treadway, and the availability of places to divert the water.

Final placement of waterbars is dictated by terrain. They must be placed where diverted water does not return to the trail. If this is not possible, a waterbar should not be installed (e.g., where the trail lies in a high banked swale that requires extensive excavation in order for the waterbar to function properly).

The greater the slope and the more water channeled by the trail, the greater the need for waterbars. They should be placed below all points where a significant amount of water enters the trail. On uniform sustained grades, waterbars should be placed near the top of the hill to divert water before it does damage with others constructed periodically down the grade to keep water flow to a minimum.

#### Frequency of Waterbars

Material Type	Grade (percent)						
	2	4	6	8	10	12	15
Loam	350'	150'	100'	75'	50'	*	*
Clay-Sand	500'	350'	200'	150'	100'	50'	*
Clay or Clay-Gravel	-	500'	300'	200'	150'	100'	75'

\* These grades not recommended in this soil material.

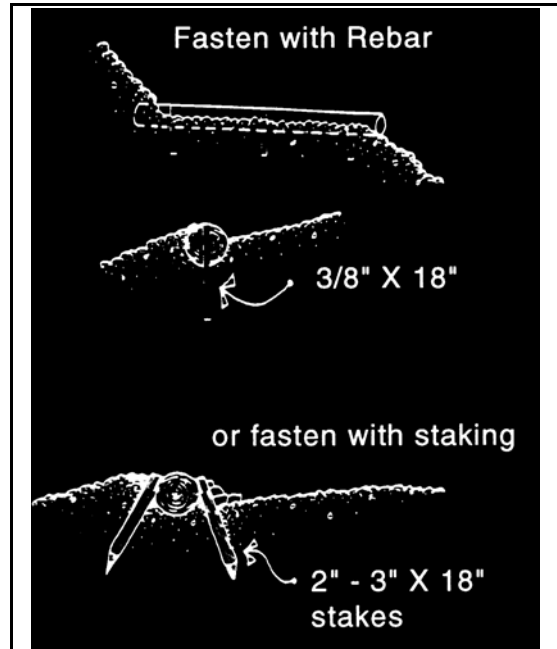
- No diversion required for soil stability.

#### ➤ Construction

After waterbar spacing and location is determined, a trench should be dug across the trail at about a 45° angle. Waterbars may slow water too much causing it to clog with silt and debris if less than 30°. Those placed at 45° or more will tend to be self-cleaning. The trench should be deep enough to contain about ½ of the diameter of a log waterbar or ¼ of the height of the rocks used for a rock waterbar. The waterbar should be a minimum of 4 inches above the level of the ground on the uphill side and should extend 12 inches into the side of the hill and 6 inches beyond the side of the trail on the downhill side. The waterbar should be securely fastened in place using one of the techniques illustrated in Appendix 1, or with stakes obtained on site.

Re-bars are often used to fasten log waterbars in place. When used, holes are drilled through the log at a slight angle and the re-bars driven so that no portion protrudes above the log. If using native material for stakes, a tree 2 to 3 inches in diameter should be cut into 18-inch pieces. The stakes should be driven on each side of the log waterbar, with the tops of the stakes slanting over the bar, so the stakes tend to pin the log to the ground. The stakes should be flush with the top of the waterbar—excess should be trimmed to prevent a tripping obstacle or their loosening from being kicked.

On the uphill side of the waterbar the tread should be graded several feet down into the trench. All excavated soil and rock should be placed on the downhill side of the bar and packed so the tread is flush with the top of the waterbar. Waterbars require regular maintenance so that they continue to function properly. Accumulated soil and debris must be cleaned out at least annually.



**Figure 2. NORTH COUNTRY NATIONAL SCENIC TRAIL  
DESIGN STANDARDS FOR TRAIL STRUCTURES**

Standards (desired)	ROS Class			
	Urban	Rural and Roaded Natural	Semiprimitive	Primitive
<b><u>Bridges (width)</u></b>				
Hiking Segment	60"	36"	28"	*
Accessible Segment	72"	48"	36"	
<b><u>Bridge Railings</u></b>				
Hiking Segment	Y	Formula (1)	Formula(1)	Formula(1)
Accessible Segment	Y	"	"	N/A
<b><u>Bridge Rail Height</u></b>	42"	42"	42"	42"
<b><u>Bridge Engineering Design</u></b>	Y	If length > 25 ft. or height > 5 ft.	Same as at left.	Same as at left.
<b><u>Clearance above Navigable Waters(2)</u></b>	5'	5'	5'	5'
<b><u>Bridge Kickplate Required (3)</u></b>				
Hiking Segment	Y	N	N	*
Accessible Segment	Y	Y	Y	
<b><u>Other Structures</u></b>				
<b><u>Puncheon (4)</u></b>				
Hiking Segment	N/A	16-18" width	16-18" width	*
Accessible Segment	N/A	N/A	N/A	
<b><u>Boardwalk(5)</u></b>				
Hiking Segment	60"	36"	28"	*
Accessible Segment	72"	48"	36"	
<b><u>Corduroy</u></b>				
Hiking Segment	N/A	(6)	(6)	*
Accessible Segment	N/A	N/A	N/A	
<b><u>Culverts(7)</u></b>	OK	OK	OK	*

(1) Railings are required if:  $(\frac{1}{2} \text{ length} \times \text{height}^2) / \text{width} \geq 40$

(2) Navigability as defined by the individual state. Clearance requirement may vary.

(3) Kickplates are often included for safety when handrails are not required.

(4) Puncheon rests on sills and is generally less than 1' high.

(5) Boardwalk is generally less than 2' above water level and should have kickplates.

(6) Generally not acceptable—but can be used as a temporary measure in areas not defined as wetlands.

(7) Length must be calculated to provide for 2:1 fill slope beyond the normal trail clearing. Size (engineering consultation) to accommodate peak flows. Water crossing permits often required.

\* In Primitive ROS (wilderness), structures are provided only for visitor safety or resource protection—not for visitor convenience or comfort.



# Chapter 6

## SUPPORT STRUCTURES

Support structures provide for hiker convenience, comfort, or sanitation. They are not necessary to construct the trail itself. Structures should be built of quality material to provide longevity and should be designed to harmonize with the surrounding environment. If native material is used, the site from which it was obtained should be left in as natural an appearance as possible. Figure 3 includes standards and explanations of some structures. Others are more fully explained in subsequent text.

**FIGURE 3. NORTH COUNTRY NATIONAL SCENIC TRAIL STANDARDS FOR TRAIL SUPPORT FACILITIES**

Standards (minimum)	ROS Class			
	Urban	Rural and Roaded Natural	Semiprimitive	Primitive
<u>Primary Trailhead</u> (1)	As needed.	Spacing 5 miles or <u>less</u> when actual or desired use is high.  Spacing 10 miles or <u>more</u> when actual or desired use is low.	Spacing 10 miles or more.	*
<u>Campsite/Shelter</u>	N/A	Spacing 8-15 miles. Especially needed when dispersed camping along the route is not permissible.		*
<u>Developed Water</u>	Obtain from public facility or home.	Spacing 10-15 miles when potable or treatable water is not available.	Spacing 20-30 miles when potable or treatable water is not available.	*
<u>Toilet Facility</u>	As needed.	At high use areas, campsites, trailheads, and other public areas as necessary.	As needed for resource protection.	*
<u>Bench</u>	<u>May</u> be provided at selected view spots or rest areas.		Not applicable.	*

(1) Primary trailheads provide parking for a number of vehicles and contain a bulletin board or kiosk for trail information. They may be part of an existing recreation facility or can be located where the trail crosses a highway or major road.

Secondary trailheads may also be established. These have one or two small vehicle spaces or parking is not provided/discouraged because of safety considerations. They may include a small bulletin board or kiosk with trail information. Generally, these will be used when it is necessary to gain access to the NST via other trails. The secondary trailhead should be located where the named trail intersects the NST or at the beginning of the access trail. Secondary trailheads may be found in remote areas where major roads are far apart.

\* In Primitive ROS (wilderness) structures are provided only for visitor safety or resource protection—not for visitor convenience or comfort.

## **Trailhead Parking**

Parking areas should be located on public lands, when possible, and provide a suitable day-hiking experience with access to more prominent natural features along the trail. Access trails can be used to connect parking areas with the main trail. The distance between trailhead parking areas can vary considerably depending upon the need. Typically, they are between 5 and 15 miles apart.

## **Campsites or Shelters**

In many areas, particularly publicly-owned forests, dispersed camping is allowed. Hikers may camp at any point along the trail as long as they follow certain guidelines (e.g., how far off the trail they should camp and practicing minimum impact camping techniques). In areas such as state and national parks or wildlife refuges, camping is restricted to designated sites or developed campgrounds. When the trail crosses private land, camping of any kind is usually prohibited by the landowner. In large areas of public land, developed campgrounds may be located near the trail. There are also private campgrounds along the way.

The desired distance between camping areas along the trail is 8 to 15 miles. Contacting an agency or landowner to obtain permission before designation and development occurs provides an excellent opportunity for communication. The choice between developing a campsite or a shelter often is based on local preference. Ideally, needed campsites will eventually be acquired by the trail organization or public agency. Sites for overnight facilities must be selected carefully to withstand user impact. Use should be diverted from heavily eroded, delicate, or impacted sites. Hikers should be directed to overnight sites by maps, guidebooks, and signs.

In selecting a site for a campsite or shelter, the following should be considered:

- Overnight facilities should be located no more than one day's hike apart (8 to 15 miles). Availability of good sites and access to water will influence actual site location.
- Sites should be as isolated as possible to reduce vandalism and other unauthorized uses. Sites should be located at least one mile from public roads.
- Low knolls or gradual slopes that allow water to drain away, and soils that are able to withstand impacts with little erosion are the best choice for an overnight facility. Low lying areas, where drainage may be poor, and areas subject to flooding caused by high water or beaver activity should be avoided.
- Attractive vegetation or topographic features that provide partial shade and shelter from high winds should be a consideration.

- A site that is partially exposed is desirable. Some exposure can provide an interesting view, allow for breezes to disperse mosquitoes, and perhaps catch the first rays of the morning sun. However, a campsite should not stand out or detract from a neighbor's view.
- Facilities should not be located in areas that present high safety risks, such as on a cliff, or in areas subject to flash flooding, rockfalls, lightning, or other natural hazards.
- Campsites or shelters should not be located directly on the shorelines of lakes or other water bodies, and should not be readily visible from the water. A glimpse of the lake or water body from the campsite is ideal.
- Overnight facilities should be located at least 200 feet from the main trail unless topography or ownership patterns dictate otherwise. Some agencies require the campsite to be even farther from the trail. A small sign or marker on the main trail should indicate obscure sites.
- The site should accommodate no more than 7 to 10 persons. One or two flat tent sites should be included or constructed.
- An adequate, year-round source of water for cooking and washing is essential. While close proximity to water is desirable, hikers will accept sources up to ½ mile away. For sanitary purposes, it should be no closer than 150 feet from the actual campsite.
- Some type of privy or wilderness latrine (a wooden box and seat or fiberglass riser over a pit) should be provided. This should be located 100 to 200 feet downwind and at least 200 feet from the drinking water source and any surface water. It should also be located so that the land does not slope toward the drinking water source.
- A fire ring or fire pit may be provided, especially at heavier used sites where wood supply is abundant. This is preferable to several impromptu fire sites.
- Trash receptacles should not be provided. All trash should be carried out or burned.

## **Water**

Potable water is extremely important to backpackers. It can be obtained from domestic pump or pressurized water systems at developed camp and picnic grounds,

administrative sites, roadside parks, homes along the route, or from filtered or chemically treated natural sources of water.

In addition to a water source near campsites and shelters, a source should be available about every 5 miles along the trail. When planning the trail route, a water source is one of the key features that should be identified. Trail should be located to allow hikers periodic access to clear, permanent streams, lakes, or springs which will not quickly clog a portable water filter.

If an area does not have a clear, natural, or domestic water source available, one should be developed according to the schedule shown in Figure 3.

# Chapter 7

## SIGNS

In earlier times, Native Americans lashed the limbs of maple saplings or bent the entire sapling and tied it in place to mark a trail—thus leaving a sign for others. In traveling to the inland fur-gathering areas, French-Canadian voyageurs created "lop trees" to mark the portages and guide them through the maze of waterways along the Minnesota-Ontario border. These early signs were a basic form of communication.

Just as the Native Americans and voyageurs used signs to find their way through difficult areas, today's trail users rely on signs and symbols to find their way and to better understand the area. Signs identify and label facilities and points of interest. They warn hikers of dangers and unusual trail conditions. They educate hikers in the proper use of the outdoors and promote the protection of nature. Signs explain and interpret interesting natural and cultural features and management activities along the trail. They also list regulations and guidelines and serve to control unwanted or illegal activities. Perhaps most importantly, they direct the hiker by providing destinations and distances along the route.

Signs are probably the quickest and easiest way to leave the trail user with a positive impression. If the signs are high quality, well maintained, and properly located, other trail problems which are harder to solve are often over-looked (e.g., wet areas). Consistent signs are the quickest way to increase the trail's identity and the public's support for the trail.

Other objectives are to:

1. provide positive exposure of the trail to attract more users,
2. educate the user about the trail through trailhead kiosks,
3. reassure the user that he/she is on the right trail and will not get lost, and
4. control trail usage and create a safer, more enjoyable, environmentally friendly experience.

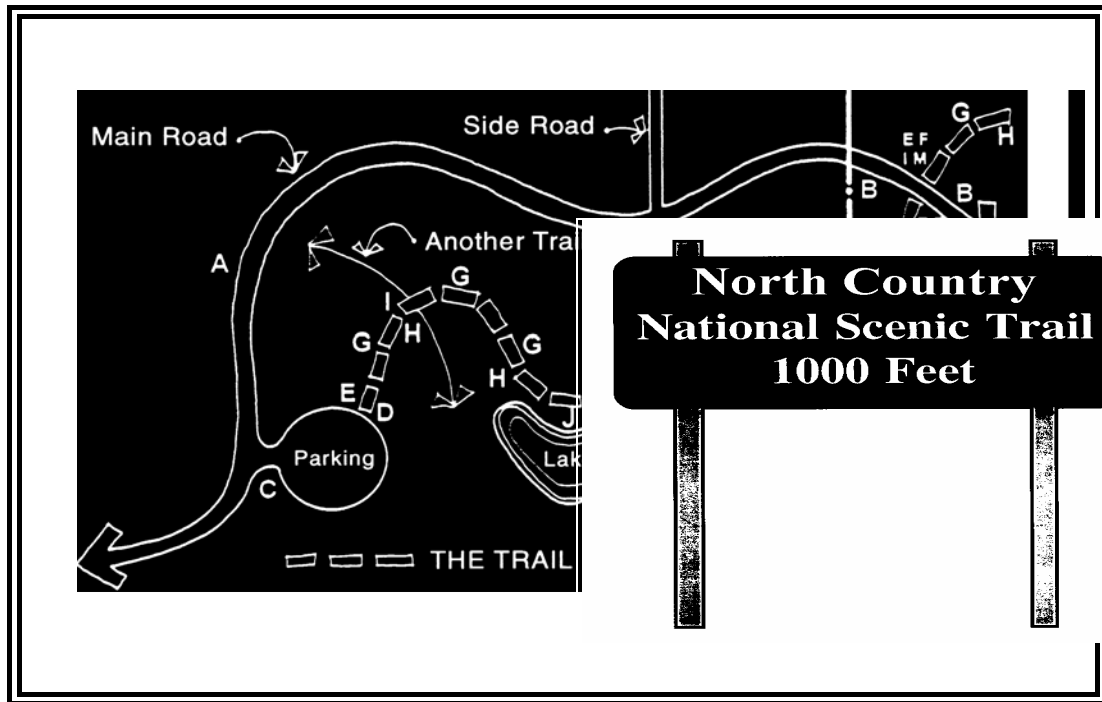
These objectives are to be balanced with aesthetic considerations to avoid "sign pollution."

The public agencies and private organizations that manage segments of the North Country NST often use a variety of signing methods. Standardization of the types and locations of signs along the trail is desired. While these standards call for new signs to replace some currently in use, this does not need to occur until the existing signs are no longer in a suitable condition. Managing authorities are urged to identify signing needs as part of the annual trail assessment process. An inventory of existing signs should be regularly updated. It is recommended that as new signs are needed—or existing signs need replacement—the uniform signing standards suggested in this chapter be followed.

## **TYPES OF SIGNS**

The following types of signs and markers will be discussed in this chapter. See Location of Signs diagram for their relative locations.

- A. Information signs for highway users
- B. Warning (Pedestrian Crossing) signs for highway users
- C. Entrance sign
- D. Trailhead Information sign/Kiosk
- C. Regulatory (usage control) signs
- D. Road Crossing signs
- E. Reassurance markers/blazes
- F. Direction change indicators
- G. Confirmation/Identification signs (trail logos)
- E. Interpretive signs
- F. "Crossing Private Land" signs
- H. You-Are-Here signs
- I. Destination signs
- N. Boundary signs
- O. Adopter signs



### A. Highway information signs

These are the typical white lettering on brown background recreation-related signs seen along highways. They can only be installed with the approval of the responsible highway department or agency that controls the road—such as the Wisconsin DOT or the Minnesota DOT. Highway departments often perform their own design work and have their own personnel install these signs. Some departments will provide the signs while others will expect to be reimbursed.

The recommended wording is: "North Country National Scenic Trail - 1000 Feet." Highway departments calculate the size of the sign and the distance from the parking lot based on the posted highway speed limit and the Manual of Uniform Traffic Control Devices (MUTCD).

### B. Warning (Pedestrian Crossing) Signs

These are standard MUTCD Warning Signs. They have black lettering on a yellow background. These should be installed in advance of trail crossings where trail use and road conditions warrant. These signs are especially important where visibility is limited due to road curvature, vegetation, or hills. If these signs are needed, the highway department should be contacted for concurrence. They may or may not install these signs.





### C. Entrance Sign

Entrance signs should be installed at all primary trailhead locations where parking is available. Preferably, the entrance sign should be two-sided and placed perpendicular to the highway, located just off the right-of-way and near the entrance road. This increases effectiveness in directing the user to the trailhead. However, because of site conditions, some entrance signs may be one-sided. If in the right-of-way, a permit must be obtained from the responsible highway department.



Entrance signs should be the standard NPS-type metal signs with white lettering on a brown background and read "North Country National Scenic Trail," with the trail logo on the right hand side. They should be approximately 3' × 6'—or another similarly proportioned size—and be mounted on solid, well designed, wooden, stone, or combination sign support structure. Optionally, a matching metal segment name strip could be mounted underneath the main sign to indicate a local trail name. If done, the lettering and color should match the main sign.

There may be other locations and situations where this sign or a smaller version may be appropriate to call attention to the trail—such as at a major recreation site.

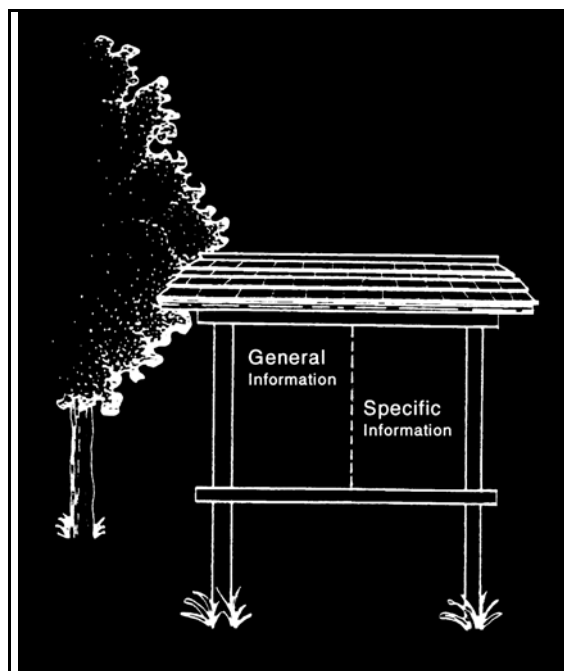
### D. Trailhead Information Sign/Kiosk

A trailhead sign or kiosk should be installed at all primary trailhead locations (see Chapter 6) where parking is available. This structure should be built within 50 feet of where the trail leaves the parking lot and should include a roof and a double or triple bulletin board structure. Some agencies on the North Country NST have adopted a triple bulletin board constructed with a roof. A well designed and maintained trailhead kiosk presents a variety of information and serves to consolidate signing clutter that otherwise would be more spread out along the trail.

The left display panel should contain general information about the trail (the seven-state map)—similar to the map and information shown on the NPS brochure. It should depict the general location of the trail in relation to other major landmarks, such as the Great Lakes.

The right display panel should contain specific information about the trail segment, including local trail interpretation. A map should show the trail as far as the next trailhead in either direction. It should also include regulatory and safety information, and information about temporary trail detours.

All kiosks should be either weather-tight to protect permanent information such as maps and regulations, or utilize weather/vandal resistant materials such as waxed poster board, fiberglass embedment, or other long lasting materials. Cluttering the kiosk with quickly prepared



information on short lasting paper should be avoided. Frequent, regularly-scheduled maintenance of kiosk displays is imperative for maintaining a professional appearance. Replace faded display materials as necessary, remove spider webs, dead bugs, accumulated moisture, and so on. Additional interpretive information can be included on the segment map panel. Kiosks are good locations to install trail registers. Design specifications for \*one style of\* kiosk are shown in Appendix \*3\*.

## E. Regulatory (usage control) Signs



While kiosks should contain information on the kinds of use allowed on the trail in a positive tone, it is recommended that all trail segments have signs which show acceptable and unacceptable uses at entry points. This is especially important where problems have occurred.

There are two options for regulatory signs. (1) Carsonite type posts with strip decals as shown at left, \*and in Appendix 3-2\* or (2) larger format signs mounted on Carsonite or wooden posts—to be used where the standard 3"wide vertical decals are not prominent enough, such as at busy trailheads or major road crossings. This strip decal should be placed directly below a trail identification emblem (see item I) \*and can be found by any managing agency's or organization's logo (e.g., the USFS shield, the Buckeye Trail Association emblem, etc.).\*

In order to avoid over-signing, these will emphasize the permitted use. On a particular segment where non-permitted uses are experienced, international symbols with a "slash" can be added lower on the post to help control the problem.

These signs should be placed at all access points such as trailheads, road crossings, junctions with other types of trails, etc. Further usage control measures, such as barriers or stiles, may have to be employed in those areas where the trail is subject to illegal use.

## F. Road Crossing Signs

These provide information to the hiker, \*increase trail identity and help create a “look of continuity”\*—not the vehicular public. Road Crossing signs actually refer to a location—not a new category of sign. Road crossings call for a collection of other types of signs found in this chapter. At many road crossings, signing may be subtle if calling attention to the trail is not desirable. This is especially true where unacceptable parking situations could develop. Carsonite posts should be used at these locations, and where the trail crosses other significant trails, logging roads, or low speed township or county roads. They should contain:

1. Trail logo.
2. Directional arrows if there is a short jog in the trail.
3. Usage signs.
4. Name of road being crossed (optional).

At major road crossings, it may be appropriate to add a 9" trail emblem. If used, these should be mounted on a post facing and parallel to the road at the edge of the right-of-way.

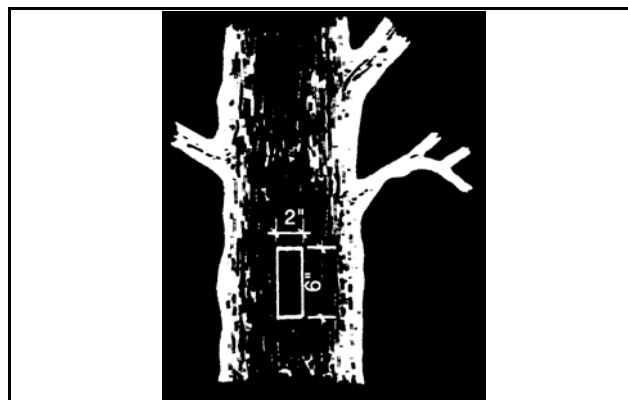
### **G. Reassurance Markers/Blazes**

It is not cost effective or desirable to use the official trail logo as the sole marker along the trail. Other types of markers which are less costly, less visually obtrusive, and less prone to vandalism should be used between points where the official trail logo has been placed. Reassurance markers are the paint or nail-on "blazes" that mark the trail.

Blazes are placed on trees or posts, slightly above eye level so that hikers can see them easily when traveling in either direction. In areas where the trail receives winter use, blazes are placed higher so they are visible above the snow. Blazes should be within "line of sight"—when standing at a blaze marker, the hiker should be able to see the next one. Blazes should be placed on trees that "strike the eye." One well placed blaze is better than several that are poorly placed.

Blazes should be continuous—even along road segments and other unmistakable parts of the trail. Blazes should be placed immediately beyond any trail junction or road crossing—even if there is a directional sign. A second blaze (for safety) should be placed within another 50 to 100 feet. Otherwise, it is not desirable to have more than one blaze visible in either direction at any one time. However, exceeding 100 yards between blazes is not desirable. Striking a balance so as not to "over-blaze" or "under-blaze" is the key. (An exception to the continuous blazing policy occurs in ROS primitive areas where blazing is not generally allowed.)

Painted blazes are often more vandal resistant than nail-on blazes, but may require more frequent maintenance. Edges and corners should be crisp and sharp. If paint is used, dripping paint, blotches, and over-sized blazes should be avoided. On rough barked trees, the tree will first need to be smoothed using a paint scraper, wire brush, or draw knife. Once the bark is smoothed, there are a number of successful paint-blazing techniques. Some trail maintainers paint free hand—using a 2" brush. Others use a sized stencil and apply the paint with a brush, sponge, dauber, etc. A high quality, glossy, exterior acrylic paint such as Sherman Williams Metalatex or Nelson Boundary Paint should be used for long durability. Spray paint is discouraged as it is more expensive and does not last as long. Neatness counts.



Vegetation should be pruned from in front of the blazes to ensure visibility in all seasons. If nail-on blazes are preferred, the NPS has a limited ability to provide them to non-federal trail managers. If affixing nail-on blazes to trees, only aluminum nails should be used. On private lands, landowner's should be contacted for preference.

### **North Country NST Blaze Standards**

Public agencies and private organizations which manage trails incorporated into the North Country NST route have established various methods of marking trails. Their blazes and other markings are a variety of shapes, sizes, and colors. To achieve as much consistency as possible the following standards are preferred:

1. Both paint and nail-on type blazes should be 2"× 6" vertical rectangles.

The 2"× 6" rectangular shape is large enough to be seen easily without being visually obtrusive and is the most universally accepted style of trail blazing. The 4" × 7" diamonds used in some areas are acceptable, but not preferred, and should be phased out whenever possible. To facilitate this movement, the NPS can supply (limited) plastic or aluminum blazes with color (as shown in item 2 below) to non-Federal partners choosing to use nail-on blazes (see Appendix 3 for a true-to-size blaze).

2. Throughout the trail, the color of choice is medium blue. The ideal blue color is available in a long lasting paint, specially formulated to last on trees (Nelson Paint Company, P.O. Box 2040, Kingsford, MI 49802; 906-774-5566). The paint is Nelson's Boundary Marking Paint, blue brush-on type \*(Pantone 308)\*. Nelson can also supply white boundary paint. Nelson paint can also be obtained from Forestry Suppliers, Ben Meadows, and other forestry supply sources. One current exception to the blue color is on the Manistee National Forest (MI) where grey/white blazes are required. Hopefully this can be changed in future forest plan revisions.

In New York, the North Country NST follows the Finger Lakes Trail for approximately 350 miles. The Finger Lakes Trail is blazed with white paint. Therefore where the two trails coincide, the color of choice is white. Eventually as the North Country NST nears completion, it may be desirable to mark the Finger Lakes/North Country Trail with both colors.

3. In non-forested areas, blazes should be placed on wooden or Carsonite posts 4 to 5 feet above the ground. Round posts are acceptable for blazes only. Treated 4" × 4" posts or Carsonite posts are required if emblems or other signs/decals are to be attached.

4. Spur trails should be distinguished by white paint (except along the Finger Lakes/North Country Trail where they will be painted the blue color shown in item 2).

## **H. Directional Change Indicators**

These are necessary in places that require extra hiker alertness (e.g., important turns, junctions with other trails, and other confusing locations). They should be used sparingly so that they do not become meaningless or visually obtrusive. They are unnecessary at gradual turns and well-defined trail locations such as switchbacks. A reassurance marker should be placed so that it can be seen from the direction indicator. Signing for hikers coming from either direction should be done.

### **North Country NST Direction Indicators**

Double blazes are the turn indicator of choice for the North Country NST. Again, because of the great diversity of this trail, flexibility in the use of directional markers is allowed. Several options and

combinations of one or more of the options are acceptable. Directional markers are shown below in order of preference.

1. Along the trail where major turns are encountered, the normal way to indicate them will be through the use of two blazes—one placed 2 inches above the other and offset in the direction of the turn. Arrows are a less preferred option.

2. At trail junctions and where the trail jogs for a short distance down a road, a double blaze is preferred, but an arrow is acceptable. At all turns, but particularly at trail junctions when turning along a road, a single reassurance marker should be visible from the direction indicator.

3. If Carsonite posts are used, the standard Carsonite arrow decal is acceptable (3" × 3", cream on brown). However, the NPS will investigate the possibility of obtaining a blue arrow on brown background in order to carry out the overall blue color scheme. If a directional arrow is nailed to a tree or wooden post, the sign should be 4" × 4". The color of the arrow is the same color as the blazes being used along the trail, on a brown background.



## I. Confirmation/Identification Signs (official trail emblems/logos)

On certified sections of the trail, the 3 1/2" trail logo should be placed at all Road crossings (even drivable woods roads), intersections with other trails, and periodically along the trail. Generally they should be about 1/2-mile apart, but frequency should increase in areas where there are numerous roads and intersections. These markers are made of plastic or aluminum for nailing to trees or posts. They are also available in Carsonite decal format. In Carsonite format, they should be used in conjunction with mileposts—if mileposts are used—and the Carsonite usage strip decal (shown in item E) at access points and road crossings. Confirmation markers will be supplied by the NPS to all non-federal trail managers. The larger 9" emblem is typically used at trailheads, major roads, and other locations where more visibility is desired.



## J. Interpretation Signs

All interpretation should be done to quality standards which complement and enhance the prominence and identification of the trail. Simple identification signs (item J-1) are relatively inexpensive and can be placed as conditions warrant.

Interpretive Signs (item J-2) and wayside exhibits (item J-3) represent a major investment in time and money and should not be installed without a coordinated, inter-segment interpretive plan—which may involve the formation of an interpretive planning team. Complete details of the interpretive planning process can be found in the 1995 Handbook-*National Scenic and National Historic Trails-Wayside Exhibit Guidelines*, available through the North Country NST manager. This handbook also contains detailed information on the content and look of Wayside Exhibits. With long, linear sites such as the national trails, the importance of continuity in design is perhaps much greater than in a small, consolidated park. Using the directions found in the handbook reduces cost, saves time, and allows the public to easily identify the trail as part of a nationwide group of scenic and historic areas. Caution should be used to avoid over-interpretation. Interpretive waysides should follow the NPS wayside exhibit specifications, and the NPS should be involved in interpretive planning and exhibit design whenever items J-2 and J-3 are being considered.

It is often preferable to provide interpretive information at the trailhead kiosk or in brochures rather than on signs along the trail. The installation and maintenance of items J-2 and J-3 is expensive and these items are subject to vandalism. However, there are places where their placement along the trail is warranted.

**1. Identification Signs:** Identification signs label features along the trail. They are simple, routed wood, identification signs which allow the hiker to find their location on a map in relation to what they are seeing. It is also appropriate to use this type of sign to identify where the trail enters an area of public land if it is not otherwise marked by the agency. They are short and concise — normally only one or two words. In most cases they consist of a name only, but may on occasion include a date. Generally, an identification sign is appropriate for all sites listed on destination signs.



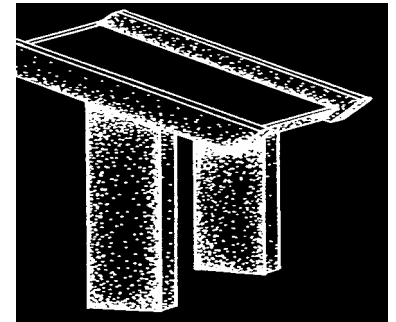
Examples of appropriate signs are:

Sunrise Lake	Paul Bunyan State Forest
Big Iron River	Red Pine planted 1955
Parnell EskerBibler Spring	
Woodtick CCC Camp 1942-44	

These signs should be 1¼" blue letters on natural colored 4" wood boards. Paint color should match the blue Nelson boundary paint used for blazes (as close as possible). They can be preserved with clear, protective coating, if desired.

**2. Interpretive Signs:** These provide an interpretation option that is not as complex or expensive as wayside exhibits (J-3). They are smaller in size and do not have as complex a mounting system. However, they include graphics as well as descriptive text and, thus, are true interpretive signs—in contrast to item J-1 which merely labels features. They are intended to interest and educate the hiker and to interpret specific sites, fauna, or flora where a minor statement is to be made—briefly showing details and giving descriptions of sites or objects without lengthy interruption of the visitor's trail tour. These signs should be high quality and constructed of durable material such as fiberglass embedment. The color should be blue or multi-colored on buff background. The size varies, but is typically from 15" × 18" to 24" × 36". If there is a need for recurring signs along the trail, these are a cost effective option—the first sign costs the most. For example, it may be desirable to interpret an esker or a kettle lake in a dozen or so locations.

**3. Wayside Exhibits:** These are the largest, most complex, and expensive of the interpretation options. Significant natural features or cultural resources may warrant the larger size and more complete interpretation which can be presented in this format. Like item J-2, these are intended to interest and educate the hiker and may be used to more fully explain historical events or sites, glacial landscapes or features, plant and animal communities, etc.—where a major statement regarding the subject can be made. Their intended use is to show details, action, etc., which are not clearly visible to the visitor upon casual observation. Major exhibits will occur much less frequently than either J-1 or J-2 for a number of reasons. They are expensive to develop and maintain and, if used too frequently, can take away from the character of the trail. (In addition to the graphic above, see Appendix 1 — mounting examples from the NPS Wayside Exhibit guidelines for National Scenic and Historic Trails, and a sheet from a supplier such as GS Images showing typical mounts for both J-2 and J-3).



## K. "Crossing Private Land" Signs

The North Country NST crosses private lands in many locations. At the current time, the NPS does not have authority to purchase lands or easements for the trail. Other agencies are acquiring limited amounts of land and a few permanent easements are being donated. Until such time as acquisition authority is available, trail passage is at the mercy of the landowner and is dependent upon their cooperation. Therefore, efforts to foster and collectively maintain good-will must be practiced. One way to assist in this effort is to educate hikers about proper conduct when crossing private lands and to

notify them when they are entering private property. This sign is intended to serve that purpose and must be located accurately.

The top portion of the sign should read, "PRIVATE LAND, USE OF THIS LAND IS A PRIVILEGE AND NOT YOUR RIGHT. STAY ON TRAIL."



The lower part of the sign may contain smaller text such as the following: "The North Country NST depends on the cooperation of many private landowners. Please respect the land you travel through. Foot travel only is permitted. Camping, fires, hunting, and straying from the trail is prohibited. Enforced by the County Sheriff." This sign is yellow with brown lettering.

## L. You-Are-Here Signs

These map signs are optional. They may supplement maps at trailhead kiosks and other key locations, such as at trail intersections, along the route. You-Are-Here signs are most likely found in state parks or other places that have a highly developed, complex or confusing trail network. The other indicated methods to mark and identify the trail make You-Are-Here signs generally unnecessary. On the North Country NST, they are the exception rather than the norm.

## M. Destination Signs

Destination signs show direction and distances to various spots along the trail. They are an important source of information both for long distance hikers and day hikers, and can serve to increase the use on under-used sections of the trail. If someone knows that there is a waterfall, lake, or other attraction down the trail, they may be tempted to hike to it and thus become intrigued with the trail idea. Destination signs supplement the identification signs shown in paragraph J-1. They are optional but desirable. These signs will have blue letters on natural wood-color background.



The trail name will be 2" letters and the destination names will be 1" letters. Appropriate places for these signs are: trailheads, major roads, shelters, trail junctions, and spur trail junctions (to indicate distance to water or shelter). They may contain the following information:

1. The name of the trail,
2. Significant destinations such as rivers, road crossings, shelters, campsites, waterfalls, etc. along the trail,



3. The direction to these destinations indicated by arrows (arrows may not be needed, depending on sign placement—for instance if a sign is placed on each side of a road), and
4. The distance to the destinations in miles and tenths.

## **N. Boundary Marker Signs**

In those locations where a corridor or easement has been acquired, these signs are used to permanently mark the trail corridor boundary. They are not necessary where the trail passes through large areas of public lands. White Carsonite type posts with blue decals and white lettering should be used. One side of the post should say "Private Land Behind This Sign"—similar to Carsonite decal PL-260, except for coloring. The other side should say "Property Boundary, National Scenic Trail Corridor Behind This Sign"—similar to Carsonite decal SP-401, except for coloring. Currently, off-the-shelf decals with the coloring and wording specified above are not available. Therefore, illustrations are not included. The National Park Service will work with a supplier to develop these decals when the first request for their use is made. Requests for these decals can be made to the North Country NST manager.

## **O. Adopter Signs**

While these signs are optional, it is often appropriate to identify the volunteer(s) responsible for the maintenance of a particular segment of the trail and recognize their efforts. Trail adopters typically are assigned a segment of trail between two identifiable points—such as road crossings. Adopter signs will normally be affixed to the post which holds the Road Crossing Signs (item F). A variety of formats, including discs that recognize the efforts of a group (such as the North Country Trail Association, the Finger Lakes Trail Conference, the Buckeye Trail Association, etc.) or a small strip or sign recognizing the efforts of an individual are acceptable. If used, the coloring should be blue lettering on a white background.

## **P. Connector Signs**

Certified sections of the trail are marked to the standards shown earlier in this chapter. Other temporary segments of the route which currently follow roads or other types of trail which are uncertifiable are generally not marked. To further the goal of marking the entire trail for public use, connector signs have been developed. These decals are shown in Appendix 3. The emblem shown at the top of the decal is also available in plastic, nail-up format.

The North Country Trail Association has developed a policy and explanation of the end-to-end marking concept. See Appendix 3.

**Figure 4. NORTH COUNTRY NATIONAL SCENIC TRAIL SIGN SUMMARY**

Sign Type	Material	Background Color	Letters	
			Color	Size
Highway Information Signs	Aluminum or HDP	Brown	White	MUTCD-varies
Warning Signs	Aluminum or metal	Yellow	Black	MUTCD-varies
Entrance Signs	Aluminum or HDP	Brown	White	MUTCD-varies
Trailhead Kiosk	Wood	Brown	NA	NA
Regulatory (Usage) Signs	Decal, Alum., Plastic	Brown	White	varies
Blazes	Paint, Alum., Plastic	Medium Blue	NA	NA
Trail Emblems	Aluminum, Plastic	NA	NA	NA
Interpretation #1	Wood	Natural Wood	Med. Blue	1¼ inch
Interpretation #2 and #3	Fiberglass Embedded	Buff	Multi-color	varies
Crossing Private Land	Plastic, Aluminum	Yellow	Brown	NA
Destination Signs	Wood	Natural Wood	Med. Blue	Trail Name-2 inches Destinations-1 inch
Boundary Markers	White Carsonite® Post	Medium Blue	White	NA
Adopter Signs	Decal, Plastic, Aluminum	White	Med. Blue	NA
*Connector Signs*	*Decal*	*Brown*	*White*	*Varies*

HDP = High Density Plywood

MUTCD = Manual of Uniform Traffic Control Devices

NA = Not Applicable

## Sign Maintenance

Sign maintenance is critical to the operation of a quality trail system. Well maintained signs that are repaired promptly convey a sense of pride and reduce further vandalism. Signs are a highly visible representation of the quality of the trail. Their maintenance or lack of maintenance leaves the visitor with a positive or negative impression about the trail. Signs convey many kinds of information and it is critical that they be in good shape. Special attention should be given to those that are damaged from shooting and other factors, those that are faded or brittle from long exposure, and those that are simply missing. All signs that are damaged or weathered so they no longer convey a good impression or serve the intended purpose should be repaired or replaced. Periodic painting and other maintenance is a necessity and will prolong the life of a sign.

Priorities for sign maintenance are:

1. Signs required for user safety,
2. User restrictions and advisory signs,
3. Destination and identification signs, blazes, and trail logos, and
4. Informative and interpretive signs.

# Chapter 8

## SAFETY CONSIDERATIONS FOR TRAIL WORKERS

National scenic trails have had impressive safety records over the years. With so many volunteers contributing thousands of hours each year, under arduous conditions, this is remarkable. Most volunteers and crew leaders understand the importance of being safe and are mindful about protecting themselves and others. Still, it is easy to become lax and forget basic safety rules. It is impossible to cover all aspects of safety in this handbook—there are entire books written on the subject. Crew leaders and others are encouraged to investigate more detailed sources of information such as agency specific safety handbooks, manufacturer's instructions accompanying individual tools, and on-the-job training from more experienced workers. The purpose of this chapter is to remind trail workers of some basic common-sense rules and offer brief insights for a continued safe work record.

Above all else is attitude! Crew leaders should not make the assumption that everyone thinks the way they do. Considerable time should be spent going over safety rules before each work-outing.

### SAFETY RULES

1. Tools should be carried in the safest way. The tool should be gripped by the handle about 6 inches behind the head (or at the balance point) and carried to the side, on the down-slope side of the body rather than over the shoulder or as a walking stick. This prevents injuries due to falling on the tool, since it can be easily tossed away when carried correctly. Tools with sharp blades should be carried with the blade facing the ground and equipped with a sheath to prevent accidental cuts and to retain their sharp edge. The sheath should remain on the tool while it is carried to the worksite and removed only when used. Bulky or clumsy items should be held with two hands or carried by two people.
2. Plenty of room should be allowed between volunteers for walking and working—generally 10 feet between each crew member.
3. Crew members should always be aware of what others are doing and take full responsibility for their own safety and the safety of others.
4. The right tool should be used for the job.

5. The "Scan-Shout-Swing" order of doing things should be implemented. Crew members should look around to make sure no one is in harm's way and there is plenty of room to swing safely. If necessary, brush or limbs first should be cleared to avoid injury from a deflected tool. Second, intentions should be communicated and third, when all is clear, crew members may proceed.
6. Trail hazards should be removed as they are encountered, or their presence communicated to other workers down the line—either verbally or with a temporary sign (for instance, a temporary sign could warn others of a nearby yellow-jacket nest or a poorly supported leaning tree). Hazards should be removed as soon as practical to prevent others from being harmed.
7. Dehydration, heat stroke, lack of energy, and hypothermia are life-threatening concerns. First aid supplies should be kept on hand and every crew member should know what is available and where it is kept. If working in remote locations, someone should know the crew's location and expected time of return.
8. *Machismo* should be saved for the football field—it's easier to be carried off a football field than it is to be carried out of the woods.
9. Crew members should be aware of their physical condition and limitations—weariness can lead to accidents.

## LEADING A WORK-OUTING

Safety is the number one priority in all volunteer trail operations. Crew leaders are responsible for briefing crew members to maintain a safe working environment and instilling in them a sense of responsibility. Every work leader should learn and teach his/her crew safe work habits and see that these practices are adhered to. Every tool is a potential source of injury and everyone can not be watched, at all times. Therefore, ground rules must be established at the beginning and taught by example.

The correct tools for the job should be selected and inspected. Blades should be sharp, handles smooth, and heads securely fastened. Tools should be properly cared for and used correctly. Crew leaders should demonstrate proper carrying and handling techniques before leaving the parking lot. See some suggested safety guidelines in Chapter 10 - Selecting the Right Tool.

Careful planning will prevent problems during the outing. A checklist of supplies and safety-briefing points is a must.

### Sample Checklist

First Aid kit  
Insect repellent

Tools (list)  
High energy food (list)  
Water (adequate amount for conditions)

and crew members)  
Individual water containers  
Extra rain gear or plastic garbage bags  
Extra gloves  
Hard hats  
Eye & ear protection  
Other personal protective equipment  
(PPE)

Compass  
Topo maps  
Project maps and plans  
Trail brochures  
Membership information  
Copies of "Safety Rules"

All potential participants should be told what they are expected to bring prior to the work-day. Normally, participants are responsible for their own footwear, rain gear, and gloves. There will always be a few who need an item, so crew leaders should bring extra, if they are available.

Sometimes people will bring their own tools. This is fine as long as their tools are in good condition and appropriate for the project. Inexperienced workers, for instance, seem very fond of hatchets. They are ineffective for trail work when compared to loppers, bow saws and other trail tools. Crew leaders should be firm about leaving such tools behind, and should check all personal tools for soundness.

Just because a person has brought a tool from home does not mean that he/she knows how to use it correctly. Time should be taken to discuss proper use of all tools that are going to be used that day. If there are more tools than people, the determination has to be made as to which ones are really necessary and which ones should be left behind. In most cases crew members should not carry more than one tool, except when walking in to major project sites. An exception to this is when small tools such as wire cutters for old barbed wire can be carried in a pocket or day-pack. In addition to teaching basic rules, a crew leader must also discuss other precautions (see poisonous pests below).

Crew leaders must be aware of any signs of fatigue, dehydration, or heat stroke among crew members. If someone seems to be having trouble, crew leaders do not need to draw undue attention to it, but should not ignore it either. Crew leaders should ensure that everyone is getting enough rest periods and water.

Finally, this should be a good experience for everyone—if the experience is positive, people will come back for the next work-outing.

### **Special Considerations When Working with Youth**

If supervising young people (especially teens who have a history of problems) crew leaders should take a deep breath, sit back, and relax. Crew leaders of youth are to be congratulated for having accepted such an important and challenging endeavor. The first prerequisite is to learn stress reduction and relaxation techniques. The following tips may be helpful:

1. Safety is priority from the very beginning. Crew leaders should let members know that mishandling of tools or abusive behavior toward others is not tolerated—the reason being that they genuinely care about the crew members, the continuation of the program, and performance quality.
2. Crew leaders should establish a rapport by doing things with the teens that are fun (like jumping in a lake, or picking berries) and by being tolerant of other bothersome things the youth might do (like when they start making fun of the functional clothes crew leaders wear).
3. It is essential for crew leaders to have a sense of humor.
4. Crew leaders should be impeccable role models—but not afraid to admit their own mistakes.
5. Crew leaders should empower the youth with a can-do spirit—not a spirit of invincibility but one of humble self-reliance built upon cooperation.

Working with youth—especially those often referred to as "at-risk", is not something that is for everyone. It is a job that can be both extremely rewarding and extremely frustrating. However, it is clear that teaching youth the importance of respecting themselves and each other, by practicing safety and strong work ethics, can make a real difference in their lives and in the life of the trail.

## **USING THE RIGHT TOOL FOR THE JOB**

Using the right tool for the job is directly related to safety. Using the incorrect tool for the job can lead to tool breakage, slips, and injuries. For instance:

- A shovel should not be used to chop away at a large root in the ground. Shovels were designed for digging and moving dirt—not chopping solid wood. A cutter mattock, pulaski, or axe should be used for chopping.
- A small hammer should not be used to drive spikes into railroad ties. Carpenter's hammers (16-ounce claw hammers) are made for nails—not spikes. A 4-pound hammer or sledge should be used to drive spikes.
- A bow saw should not be used like a weed cutter. Bow saws are designed to cut through wood—not be swung at weeds or brambles. A Suwanee Sling or other weed cutter should be used to cut weeds.

Using tools improperly is one of the chief causes of accidents. Chapter 10 should be studied to understand which tools can best do the work that awaits the crew.

## **FIRST AID**

Ideally, all crew leaders should be certified in first aid by the American Red Cross. A first aid kit should be checked, complete, and large enough for the crew and the job at hand. Above all, it should be taken along on the job, and crew members advised of its location. Professional assistance may be hours away.

## **POISONOUS PESTS**

**Ticks** - Wood ticks are a nuisance, but seldom pose medical problems. Skin and clothing should be checked and any ticks that are found should be removed.

Deer, or bear ticks, on the other hand, are potentially very dangerous. These ticks, which are much smaller than wood ticks, can carry the bacteria that causes Lyme Disease. Generally, only about one percent of all deer ticks are infected with the Lyme disease bacterium. However, in some areas more than half of them harbor the microbe. Most people with Lyme disease become infected during the summer, when immature ticks are most prevalent. Except in warm climates, few people are bitten by deer ticks during the winter months. Ticks should be removed from clothing and body as soon as they are observed. Research suggests that a tick must be attached for many hours to transmit the Lyme Disease bacterium, so prompt removal can prevent the disease. A thorough tick-check at the end of the day is advised. Immature deer ticks are only about the size of a poppy seed and may easily be mistaken for a freckle or a speck of dirt. The risk of developing Lyme Disease from a tick bite is small—even in heavily infested areas. Most physicians prefer not to treat patients bitten by ticks with antibiotics unless they develop symptoms of Lyme Disease.

### **Tips for Personal Protection**

- Wear light-colored clothing so ticks can be easily spotted.
- Wear long-sleeved shirts and closed shoes and socks.
- Tuck pant legs into socks and tuck shirt into pants.
- Apply insect repellent containing permethrin to pants, socks, and shoes, and compounds containing DEET on exposed skin. Do not overuse these products.
- Walk in the center of trails to avoid overgrown grass and brush.



- After being outdoors in tick infested areas, remove, wash, and dry clothing.
- Inspect your body thoroughly and carefully remove any ticks.
- Inspect pets for ticks.
- Your local health department and park or agricultural extension services may have information on the seasonal and geographic distribution of ticks in your area.

### **How to Remove a Tick**

- Tug gently but firmly with blunt tweezers near the “head” of the tick until it releases its hold on the skin.
- To lessen the chance of contact with the bacterium, try not to crush the tick’s body or handle the tick with bare fingers.
- Swab the bite area thoroughly with an antiseptic to prevent infection.

**Mosquitos** - Like wood ticks, mosquitoes are a nuisance but they are not particularly a safety hazard. Repellents should be used and/or long sleeved shirts and long pants worn. Herbal repellents can be used to cut down on the amount of DEET found in other repellents, if workers prefer.

**Poison Ivy** - Some people are extremely allergic to this easily identified plant. If seen, others should be alerted to its location so they can avoid it. A line of Technu ® products, available in most drug stores, can help prevent contracting the poison.

**Poisonous snakes** - Poisonous snakes are infrequently encountered. Their presence along the trail varies tremendously, depending on the state and the location within the state. Generally, snakes will move away from people if they hear them coming. The danger from poisonous snakes is greatest when the snake is surprised. In poisonous snake country, there are several precautions which can be taken to decrease the chance of being bitten. Gloves should be worn when moving fallen logs or other debris, high-top leather boots should be worn, stepping over large logs should be avoided and crew members should take care where they put their hands and feet.

If working in poisonous snake country, a first aid class should be taken or first aid books made available to crew leaders and members so appropriate action can be taken in case someone is bitten. Generally, if a doctor can be reached within one to two hours, drastic measures of treatment such as incisions and tourniquets should be avoided. The person with the bite should be kept calm and escorted to the nearest doctor immediately. The injured should not run as this will cause the heart to more quickly pump the poison throughout the body. From many locations it is feasible to reach a doctor within the one to two-hour time frame. If a crew is working in a remote area, members should be prepared to administer first aid.

**Spiders** - Like snakes, poisonous spiders are infrequently encountered and are no more common in the woods than in a typical backyard. However, the brown recluse spider may be present in some areas, so an inspection of seldom-worn clothing is recommended prior to dressing. Sleeping bags should also be shaken out before use.

**Deer Flies and Black Flies** - Wearing hats and long sleeve clothing is the best preventive measure for these nuisances.

**Yellow-Jackets and Hornets** - These pests can cause painful stings and more serious allergic reactions. Persons who know they are allergic should carry a complete sting kit including antihistamine inhalants and other supplies. Crew leaders should check with crew members to see if anyone is allergic and to be sure they have their kit with them. The crew first aid kit should also be equipped with both "sting-kill" ampules and treatment for allergic reactions.

All members should be aware of insect nests and warn others of their presence. It is often the second and later crew members who get stung, as the first person who steps into or bumps a suspended nest has moved out of harms way by the time the insects attack. Yellow jackets typically nest in the ground while hornets build their nest in bushes and trees. If the pests cannot be killed and the nest destroyed, work elsewhere until a later date. If a nest is discovered the area should be marked with flagging or a temporary sign to alert others.

At certain times of the year and in certain kinds of weather, yellow jackets seem to be more aggressive. Generally this is in late summer and fall and during periods of dry weather. During these times, yellow jackets are attracted to food and drink. All members should be alert when eating or drinking pop to avoid getting a yellow jacket in the mouth. A sting in the tongue is particularly serious as the tongue can swell and quickly block the airway.

## **SIMPLE PRECAUTIONS**

Crew members should work in clothing that covers most of the skin. Good quality work boots (best if they have a steel toe), a hard hat and gloves should be worn. With power equipment (like a chain saw) safety goggles, ear protection, and high quality chain saw chaps should be used.

Frequent water and rest stops are recommended. Crews should use common sense and not try to do more than is prudent.

# Chapter 9

## MAINTENANCE

The objectives of trail maintenance are to: provide for user safety, access, and convenience, protect adjacent resources, and preserve trail investment. Maintenance begins immediately following trail construction and is a continuous process.

Sometimes questions arise whether seldom used stretches of trail are worth the time and effort required to maintain them. However, if the trail is not maintained, why should anyone hike it? All trail should be maintained in the best condition possible—a well-maintained trail is self-perpetuating.

### TRAIL ASSESSMENT AND INVENTORY

#### Trail assessment

For routine maintenance, a detailed trail condition assessment may not be necessary. However, there may be sections of the trail where it is not possible to complete all maintenance immediately or where more help in terms of labor and/or money is needed. For example, during a routine walk through, a severely-eroded, rather lengthy trail section may be noted. Since the best solution for a severely eroded trail section may be to relocate it, the work is not within the capabilities of an individual maintainer to correct immediately. In that case an assessment is needed so that the major needs can be made known to the local managing authority and the NPS. With this information at hand, funding or labor may be found to assist in correcting the problem. A maintenance assessment can also serve as a basis for applying for Challenge Cost Share funds. One way to accomplish an annual trail assessment and document heavy maintenance needs, or to just provide information on the condition of the trail, is through the use of a trail assessment or inventory form. An example is shown in Appendix 2. (Agencies or clubs may use their own, if available.)

#### Inventory

A more detailed inventory of trail features and required maintenance is desirable as the trail moves closer to completion, as trail managers become more knowledgeable, and as the NPS or the North Country Trail Association (NCTA) and its affiliates increase management oversight capability. An electronic database is capable of generating various reports including maintenance needs. An inventory similar to either the Appalachian Trail Conference's TREAD database, or the proposed Ice Age NST Trail Inventory and Assessment Process (as shown in Appendix 2-B) should be considered. At this point it is beyond the scope of this handbook to develop a database format or

require the various local trail managing authorities to use it. This level of detail may be necessary someday. If current managing authorities desire a detailed inventory, they are encouraged to proceed—keeping in mind that the selected format and the computer software should be compatible with other authorities, and that the data be easily convertible to those electronic software programs.

There are two ways to collect data for this type of database:

➤ Paper Forms

Persons using this method walk the trail and enter the data on a series of forms. The data from the forms is then manually typed into the electronic database back in the office. This method is shown in Appendix 2-B.

➤ GPS/GIS

Persons using this method walk the trail with a Global Positioning System (GPS) unit, keying in the data points and mapping the trail as they go. Back in the office, data from the GPS unit is simply downloaded to a computer and linked to a Geographic Information System (GIS). This method is the wave of the future, and not only provides a detailed inventory of various trail features, but also produces a very accurate trail map. Eventually, the master records and maps maintained by the NPS will be in a GIS.

Some agencies are already using GPS/GIS technology in their trail management activities. As this technology becomes more widely available, others will begin using GPS to inventory and map the trail. When the NPS achieves full GIS capability, data collected by others will be used. At that time, it will be important that the various trail managing authorities have been inventorying similar kinds of trail features and collecting similar data. Therefore, a GPS Data Dictionary is shown in Appendix 2-C. It will be helpful for those who are using GPS technology to duplicate this data dictionary and collect the information shown, if it occurs on that segment of trail.

## **MAINTENANCE ACTIVITIES**

When assessing trail maintenance needs, the following groups of general maintenance categories should be considered. Some of the more common maintenance activities

required to remedy deficiencies identified during the annual trail evaluation could include:

**Trail Maintenance-Vegetation:**

- Brushing/clearing areas
- Remove fallen trees/branches
- Hazard tree removal
- Slope revegetation
- Backslope grooming
- Vista maintenance
- Poison Ivy removal (herbicide)

**Sign Maintenance:**

- Sign repair/rehabilitation
- Sign replacement
- Blaze repainting and maintenance
- Cairn repair
- Barricade/closure device repair

**Drainage Maintenance:**

- Cleaning/repairing structures
  - culverts
  - waterbars
  - Cowetta dips
  - drainage ditches
- Replacement of existing structures
  - culverts/underdrains
- Install additional drainage structures
  - waterbars
  - culverts
  - grade dips

**Structure Maintenance:**

- Bridge repair
- Cribbing/retaining wall repair
- Barrier/guardrail repair
- Steps/perron repair
- Fence/gate/stile repair
- Shelter repair

**Tread Maintenance:**

- Grading tread
  - slough and slide removal
  - slump repair
  - filling erosion ditches
  - grubbing rocks/ roots/stumps
- Spot surfacing
- Turnpike section repair
- Surface replacement (similar material)
- Surface repair
- Remove loose rocks

**Litter Clean-up:**

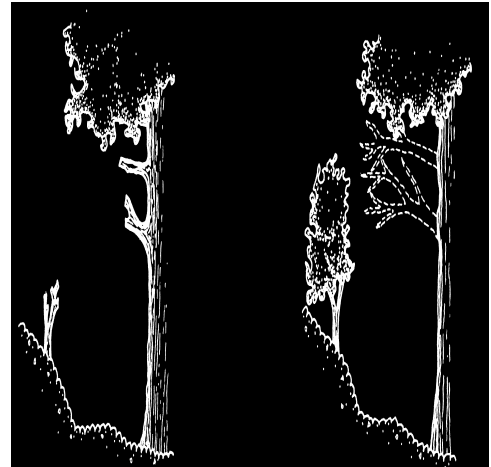
- Old dumps near trail
- Current discarded litter

**Trail Maintenance-Vegetation:** All side branches extending into the trail clearing should be cut flush with the parent branch or stem, leaving no stubs. This is safer, lasts longer, and also allows for the wound to heal naturally.

Small trees and shrubs within the tread should be grubbed out to prevent tripping. Holes should be filled and compacted.

Trees and brush outside the tread (but inside the trail clearing) should be cut as close to the ground as possible, leaving no sharp pointed stumps or stems. Consideration may be given (especially on exotic species) to treating these cut stumps with herbicide — after obtaining proper approval.

Unless prohibited because of ROS setting, using power mowers in open grassy areas or power brush saws in brushy areas should be considered.



Fallen branches and trees should be removed except for a few large trees/logs near access points (see maintenance tips). On larger logs, remove a section only the width of the tread to further restrict unwanted use.

In high use sections of the trail or near camping areas, dead or dying trees that have a possibility of falling across the trail or camping area should be removed. In Primitive ROS areas, only those trees that may be a serious hazard to users should be removed.

**Tread Maintenance:** When tread repair is needed, it should be restored to the original design condition, free of loose stones, rock points, stumps, and roots. Attention should be given to dips and outsloping so that water does not collect on the trail.

**Drainage Maintenance:** Proper drainage protects the trail from erosion damage. Trails should be routinely inspected to ensure that all culverts, dips, waterbars, drainage ditches, etc. are free of debris and ready to function properly at all times—especially during the rainy season or spring runoff. Routine maintenance is not only necessary, but valuable in terms of labor, material, and money saved on emergency repairs, and in the number of days the trail is useable. If repairs are necessary, they should meet or exceed the original construction specifications.

**Trail and Support Structure Maintenance:** The major consideration in structure maintenance is safety. Bridges, stiles, boardwalks and all support structures should be routinely inspected in order to ensure safe conditions and intended function (see bridge inspection requirement in Chapter 5). Minor maintenance of structures should be provided by the adopter or trail crew. Deficiencies requiring major efforts should be planned as a separate project. Unsafe structures must not remain unattended. If work must be temporarily deferred, an alternate trail route should provide a bypass of the hazard.

**Sign Maintenance:** (see discussion in Chapter 7).

## **FREQUENCY OF MAINTENANCE**

Most trail segments need maintenance about three times per year.

**Prior to Memorial Day** - This may be the maintenance period that involves the most work. The objective is to get the trail ready for the spring hikers. In addition to general trail cleanup, some of the more important tasks are to:

- Remove tree limbs and fallen trees from the trail, and prune encroaching limbs as needed.
- Repaint or replace the blazes if they are faded or missing. (Be sure that they are not obscured by vegetation—consider growth that occurs before the next maintenance).
- Make sure that all signs and trail emblems are in place and well maintained.
- Inspect for water in the trail and take corrective action.
- Carefully inspect all bridges—immediate safety needs should be met and tasks which are too large for immediate action noted.
- Maintain all trailheads, campsites, and other support structures.
- Keep a list of larger jobs or those that require different tools that will require attention at some other time.
- Schedule time for major projects that were identified—round up tools and helpers.
- Pick up litter.

**Mid-Summer** - Early July is a good time to take care of annual growth so that the trail is kept clear and relatively easy to hike. The hiker should not be assaulted by weeds and briars. Some of the key jobs for mid-summer are to:

- Mow or cut all weeds, brambles, briars, and high grass encroaching on the trail. On sections of the trail that pass through fields or other places

receiving direct sunlight, mowing may have to be done on a more frequent basis—perhaps monthly throughout the summer. Brambles and briars may need to be grubbed out by the roots to prevent rapid regrowth.

- Prune all brush and overhanging limbs that have grown into the trail clearing—all blazes and signs must be visible.
- Complete the larger jobs that could not be accomplished the previous spring.
- Maintain and improve water bars, drainage ditches, and all trail structures.
- Be alert for noxious or exotic plant species—remove, kill, or inventory them for future vegetative management projects.
- Pick up litter.

**Fall** - Fall maintenance is geared toward preparing the trail for the winter months. This is a time to:

- Finish any uncompleted jobs and recheck blazes and signs—replace and repair as necessary.
- Be sure that campsites and shelters are clean and in good repair.
- Contact landowners to thank them for their support.
- Pick up litter.

## **ORGANIZING THE CREW**

Experience and knowledge of the trail will help determine what tools to take and how many persons to recruit. The most efficient way to manage trail crews goes by various names—the "overseer" system, the "trail sponsor" system, the "adopt-a-trail" system. The key is that one person is responsible for a particular segment of trail on a permanent basis, if possible. It is their responsibility to see that the trail segment is maintained, either working by themselves or by recruiting helpers. The advantage of this system is that the adopter becomes well acquainted with the segment, can deal efficiently with problem areas, and can judge how much and how often work is needed to keep the segment maintained. A disadvantage of this system is that a segment can become so familiar that problems are overlooked or it becomes boring for the adopter. One way to overcome this problem is to rotate adopters between segments every few years. A good reference on crew organization is the Appalachian Mountain Club's *Organizing Outdoor Volunteers*.



The annual trail evaluation or a pre-workday trip by the adopter can serve as an assessment of the work to be done and will facilitate crew organization. Two to four persons can usually maintain 3 to 5 miles of trail per day—depending on the individuals, terrain, vegetation, and the number of maintenance problems.

The exact kind and number of tools for a crew varies from one part of the country to another. In general, tools which are capable of cutting weeds, pruning branches, removing logs, digging and leveling trail, and cleaning waterbars are desirable. It is advantageous to rotate tools among trail workers to provide relief from repetitive motion and effort (see Chapter 10 for tool suggestions).

## **CLEANUP**

The trail must be cleared of all debris following clearing or heavy maintenance. Maintenance results should appear neat and hardly noticeable to a hiker. Inadequate clean-up can spoil even the most thorough clearing job. One person on the crew should be assigned responsibility for this job. All cut growth should be carried off the trail and scattered—not piled. If eroding gullies are nearby, the cut material can be placed in the gully to slow the flow of water and catch sediment (see the third item under maintenance tips-clearing).

All flagging, construction stakes and debris, litter, etc., should be removed.

## **MAINTENANCE AND CONSTRUCTION TIPS**

Work should be organized so every section of trail is left as complete and finished as possible.

Use should be found for as much disturbed material as possible. On every trail there are points where excess material must be removed and sections where material will be needed. Rock and soil removed from a cut on one section can be used as fill on another nearby section.

A trail does not have to be worked progressively from beginning to end. Priority should be given to sections needing the most attention. The cut sections may be worked first, followed by the fill areas. Water diversions should be installed prior to trail surfacing work to allow for natural drying and easier working conditions. If two crews are working along the same trail, work assignments and locations should be scheduled to allow for exchange of equipment and materials.

When constructing new trail, a short, unworked section should be left next to access roads until last—this helps eliminate premature use.

As construction and maintenance is finished in a segment, clean-up should also be

completed. Postponing trailside cleanup until later is poor procedure—it seldom gets done.

Time should be taken to do the job correctly the first time around to avoid having to repeat the task.

## **Clearing**

Flagging should be carried for temporary trail marking or to identify work to be done.

For light pruning work that is within reach, hand pruning shears (like those used by a gardener) are quicker and easier than long handled loppers.

A stout but flexible forked sapling (about an inch in diameter at the base) that has been cut about 4 ½ to 5 feet in length (with about a 10" fork at the end) is a very useful tool for flinging small limbs out and away from the trail. When following someone who is using a power brush saw, it is also an excellent tool for flinging the cut brush out of the trail. Used like a pitch fork, it scatters the brush so that it is not visibly concentrated, and is much more efficient than bending to pick up and discard each piece by hand.

A couple of large down logs should be left near trail entry points to discourage wheeled use. Farther down the trail, a section the width of the trail tread can be cut out of large fallen logs for the same purpose.

All main stems or trunks should be cut as close to the ground as possible—or grubbed out. It is very important to avoid leaving short stubs (trippers) as they are a safety hazard. Cut hardwood stems resprout easily, therefore, grubbing is the preferred method as it is a one time treatment.

Larger logs should be carried to the downhill side of the trail and placed perpendicular to the face of the hill to prevent them from rolling and creating a safety hazard.

If a branch needs to be pruned, it should be cut next to the trunk. If not cut next to the trunk, these safety hazards tend to develop suckers or side branches which will have to be cut again and look unnatural. Large limbs should be undercut first to prevent peeling the bark from the main stem when the branch falls.

Conifer branches and weak trees, such as alder, are easily weighted with heavy snow or rain and may require extra clearing.

## **Painting**

Clean, neat ways to carry and apply paint should be practiced. The following suggestions should be considered:

- A 1" wide brush spreads wider during painting. Some prefer using a 2" brush and little pressure so that the blaze doesn't get too wide.
- To illustrate the proper blaze size, a dollar bill is very close to 2" × 6".
- Flat grey or brown spray paint should be carried for use in obliterating old trail blazes.
- Old gloves, a wire brush, and a 2 ½" paint scraper are handy tools.
- Paint can be kept in an old, snap-top detergent bottle. Applying small amounts of paint to the brush can ensure a neater job..
- A paint brush and a small can (to hold paint) are easily carried inside a gallon paint bucket. For comfort, a piece of hose can be slipped over the paint bucket handle or it can be replaced with a wooden handle.
- Cans lined with plastic bags make for easy cleanup.
- Extra plastic bags kept in the vehicle are handy. Brushes can be wrapped in plastic so they won't dry out until cleaned at home. Another method is to bring along mineral spirits or water (depending on type of paint used) to cover the length of the brush bristles. This can be stored in a sturdy, sealable container. Extra care should be taken to avoid leakage.

## **Signs**

When using Carsonite posts, the optional anchor at the bottom should always be installed. This makes them even harder for vandals to remove from the ground while adding little expense.

When installing wooden posts, a piece of scrap lumber should be nailed to the Lower part of the post. It is easier to nail it parallel to the post—this method is just as effective as a perpendicular arrangement and allows for a smaller post hole.

# Chapter 10

## SELECTING THE RIGHT TOOL

A wide variety of tools are available for trail use. Local and individual preferences often dictate the kinds of tools which are chosen for various tasks. Some of the most commonly used tools and their functional purpose are identified in this chapter. A few tips on using the tool safely and effectively are also included. Every trail maintainer needs to learn how to choose the correct tool for the job, use it effectively and safely, care for, and store it properly. Purchasing high quality tools initially is more cost effective—long-term performance exceeds those of lower quality.

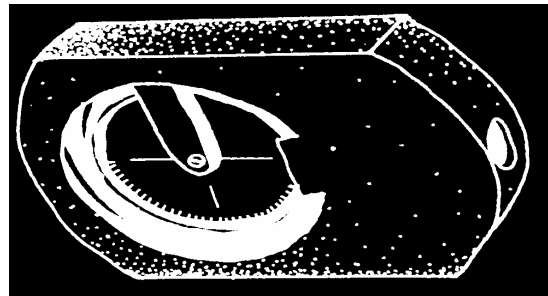
The right tool should be used for the job. Substitutes are dangerous and ineffective. Tools should be kept in good condition—throwing them on the ground can damage them. A file should be carried for spot-sharpening edges throughout the work day. Tools should be carried with the appropriate guards in place. At the end of the work day, all tools should be cleaned, sharpened, lightly oiled, and stored properly.

### HAND TOOLS

#### Clinometer

**Uses:** A clinometer is an essential tool when locating and laying out a trail. This compass-sized tool allows the user to measure the slope (grade) of a hill or trail.

**Tips:** Both eyes must be kept open when sighting through the clinometer (see Eye-Level Survey Techniques in Appendix 4).



#### Lopper

**Uses:** Cutting selected limbs or saplings during construction and maintenance phases. Larger models can cut limbs approaching 2" in size.

**Tips:** High quality loppers with replaceable parts should be used. Saplings should be clipped flush to the ground and limbs flush to the tree. Loppers must not be thrown on the ground as this may clog the head and dull the blades. At the end of the day, the blade should be cleaned and wiped with light oil.

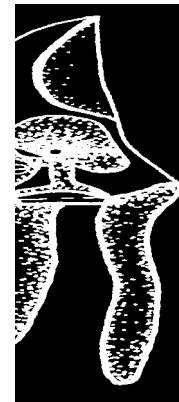
**Safety:** Leather gloves and a hardhat should be worn. Eye protection is also recommended.



### **Hand Pruner**

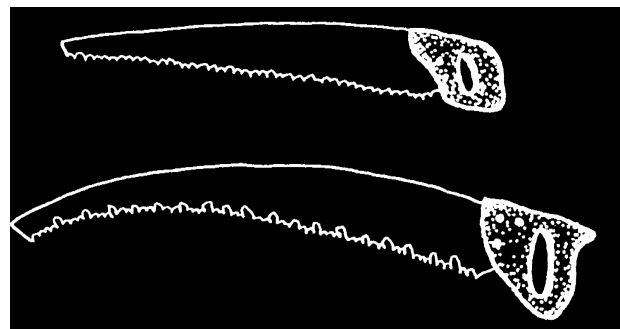
**Uses:** Cutting small branches encroaching on the trail. Also useful for cutting protruding roots that are tripping hazards. Mostly used for trail maintenance.

**Tips:** Handier and lighter to carry than a lopper when only minor pruning is needed—it should be carried in hand while hiking to clip small branches as encountered.



### **Pruning Saw**

**Uses:** Cutting limbs encroaching on the trail. Can also be used for cutting small trees or shrubs at the base and removing small to medium sized windfalls. Pruning saws come in a wide variety of sizes and tooth patterns. They range from small folding models with 6" to 8" blades to those with blades up to approximately 26" in length. Blades are curved and cut only on the back-stroke—a handy feature when removing hard to reach limbs.

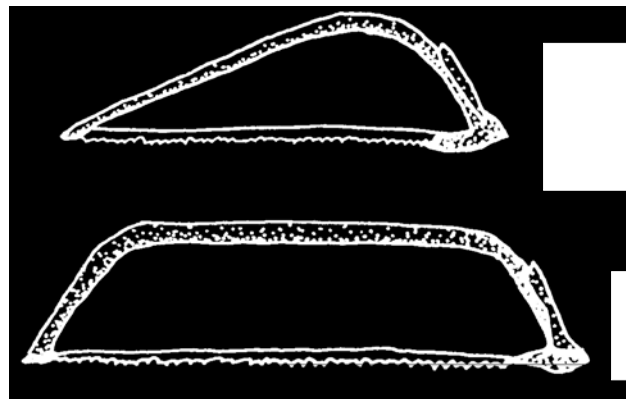


**Tips:** Pruning saws should be resharpened often. A light coat of oil should be applied to the blade after each use.

**Safety:** Except for folding models, pruning saws should be kept in a sheath when not in use. A hand holding a limb or sapling should not be crossed beneath the hand pulling the saw—this can lead to a nasty cut when the saw comes through the limb sooner than expected. Personal Protective Equipment (PPE) includes leather gloves and a hardhat.

## **Bow Saw**

**Uses:** Cutting limbs, small trees, and small to medium sized windfalls—essentially the same as pruning saws except that bow saws can cut larger material. Bow saws have blades ranging from about 21" to 36" in length. The smaller saws are generally triangular in shape and work well for pruning. Their shape limits the length and depth of the stroke to material less than 4" to 5" in diameter. The larger saws are bow-shaped and can cut material up to 8" in diameter, but are more prone to twisting and binding in the cut.



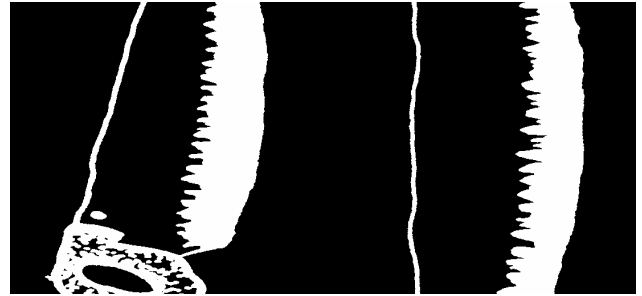
**Tips:** Bow saws cannot be resharpened due to the hardness of the blade. When the blade becomes dull, rusty, or bent, it should be replaced. It should be wiped with light oil before storing. Smaller saws are more useful—use another tool for cutting large material.

**Safety:** Same as pruning saws. PPE includes leather gloves and hardhat.

## **Crosscut Saw**

Uses:

Cutting large blowdowns and felling timber. Crosscut saws are available in two basic designs—one-person and two-person. The one-person models are generally 3' to 4' feet in length and are perhaps most useful for clearing blowdowns. Even though they



are called one-person, an optional second handle can be added. Two-person crosscuts are 5' to 8' in length, with a handle at each end. Both types are useful for constructing trail structures in remote areas. In combination with an adze, two-person crosscut saws are especially good for creating a level walking surface on native log bridges. Crosscut saws (especially two-person models) require special skills and care, but are nevertheless an attractive, lightweight alternative in remote areas. In formally designated Wilderness areas, where power tools are not allowed, crosscut saws are perhaps the only alternative for cutting large material. In less remote areas, they are used only occasionally as the axe, bowsaw, and chainsaw perform the same jobs.

Tips:

One of the biggest problems with crosscut saws is finding someone who is competent in sharpening them—if no one is available to correctly sharpen the saw, there is no use purchasing one. What was once fairly common knowledge has been largely forgotten, except by those individuals who still routinely work in remote areas. Skills in using and sharpening the saws can be learned through on-the-job experience with wilderness rangers, or by participating in a good workshop such as a Wilderness Skills Workshop conducted by the Student Conservation Association. Another source of training is the Crosscut Saw Manual by Warren Miller, U.S. Forest Service Equipment Development Center, Missoula, MT. This is available from the Government Printing Office in Washington D.C.

A crosscut saw should never be placed in the dirt—the teeth should remain clean and sharp. Generally, the saw is leaned against a tree when not in use, but care must be taken to ensure it does not fall to the ground.

Safety:

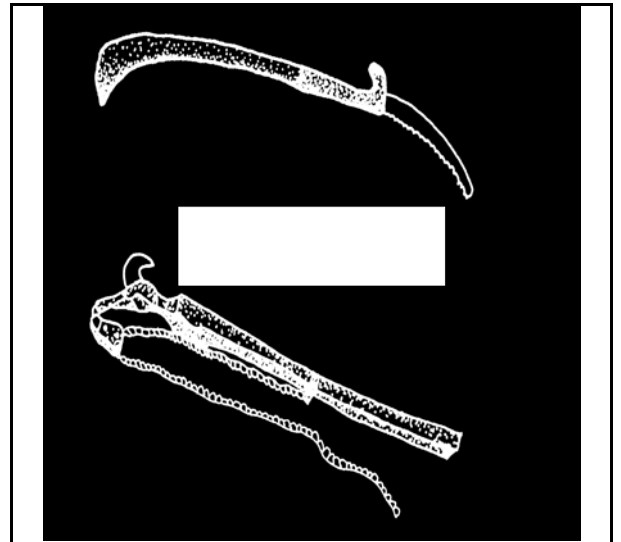
To protect both the user and the saw, a sheath should always be used. These can be manufactured using sections of old fire hose or assembled from plywood. Several good commercially manufactured sheaths are also available. As with any sharp tool, extreme caution should be used to avoid cuts. Required PPE includes a hardhat and leather gloves.

## Pole Pruner and Pole Saw

**Uses:** Cutting overhanging limbs that cannot be reached with bowsaws, loppers, and other short-reaching tools. Pruners and saws are often combined on the same handle to allow for more flexibility.

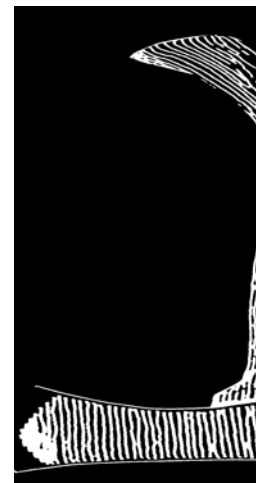
**Tips:** When cutting larger limbs with the pole saw, it is best to use a two-step process. In the first step, a 4" to 6" stub is left by making an under-cut and then a cut from the top of the limb. This prevents stripping the bark from the trunk of the tree. In the second step, the stub is removed flush with the trunk.

**Safety:** Fingers should be kept out of the pruning head. The rope may snag unexpectedly and cause the blade to close causing a serious cut. When using the saw, eye protection will prevent saw dust from getting into the user's eyes. Required PPE includes eye protection, hardhat, and leather gloves.



## Axe

**Uses:** Clearing blowdowns, limbing trees, felling trees, and hewing flat surfaces. Axes demand a great deal of practice to use safely and effectively and are used less today than they were in earlier times. They have largely been replaced by various saws and other cutting tools, but nevertheless, the axe is versatile, simple to maintain, and in skilled hands can be as fast and effective as other tools. There are two basic kinds of axes—the single-bit and the double-bit. Double-bit axes are generally preferred as they have better balance and allow one blade to be kept razor sharp for cutting while the other blade can be used for chopping roots and cutting in dirty wood. Single-bit axes are sometimes considered to be safer than double-bit axes primarily because there is less chance to fall on an exposed blade.





**Tips:** Effective axe work requires a great deal of practice, but the skills required are not as demanding as those required for crosscut saws. Skills can be acquired through working with experienced individuals or by participating in a good workshop such as a Wilderness Skills Workshop conducted by the Student Conservation Association.

On downed logs, a notch that is twice as long as the diameter of the log should be made. The blows should progress through the log and alternate from one side of the notch to the other. When removing a limb from a downed tree, the direction of the blow should be made from the root-end of the tree rather than down into the crotch.

**Safety:** Before cutting, all limbs and brush that might interfere with swinging should be removed. Springy branches or broken limbs that might deflect the blade should be avoided. The user's feet should be separated at shoulder width and firmly planted. When limbing or hewing a downed tree, the user should stand on the side opposite the one being cut to keep the tree between the blade and the user's shins. When not in use, or when carrying the axe, the blade should be covered with a sheath. PPE includes a hardhat, leather gloves, heavy leather boots, and eye protection. Inexperienced users should also consider wearing shin guards and toe guards or hard toe boots.

### **Brush Hook or Bush Hook**

**Uses:** Cutting small saplings and brush too heavy for a weed whip. Swung like an axe, the brush hook's long handle and heavy head give it a powerful cut.

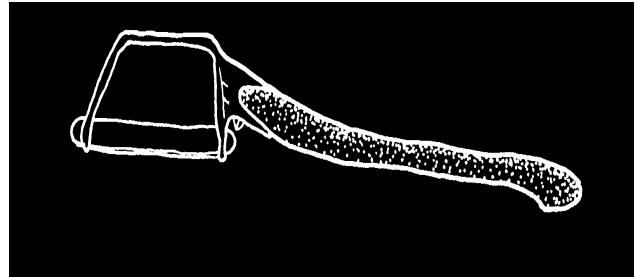


**Tips:** The blade should be kept sharp using a curved-edge whetstone.

**Safety:** Because twigs or limbs can catch the blade on the back swing or where space is limited, extra care should be taken to avoid accidents. A good grip on the handle is necessary, and it is important that the user keep clear of other workers. PPE includes a hardhat, leather gloves, and heavy leather boots.

### **Swede Axe**

**Uses:** Cutting small saplings and brush that are too heavy for a weed whip and for cutting in cramped places. Its shorter handle and lighter weight make it faster, easier to control, and safer than an axe or brush hook. The thin, flat, replaceable blade cuts easily through springy stems and may be sharpened with a sharpening stone or file.



**Tips:** The blade should be replaced when it becomes badly nicked.

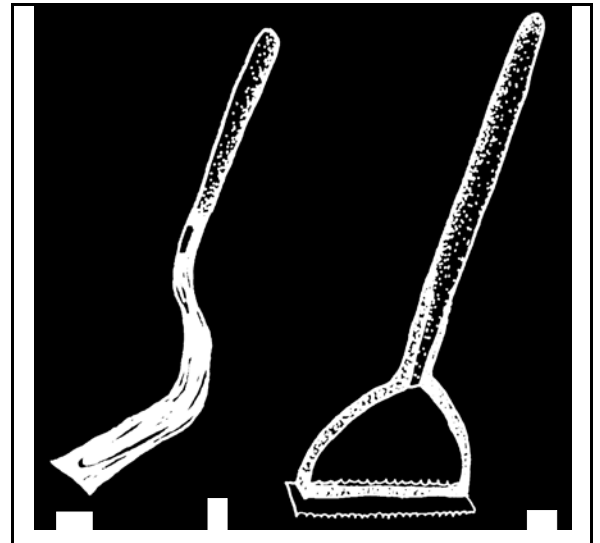
**Safety:** Same as the brush hook. PPE includes a hardhat, leather gloves, heavy leather boots. Inexperienced workers should also wear leg protection (chaps).

### Weed Whip

**Uses:** The weed whip is swung back and forth like a golf club and cuts grass, weeds, light brush, briars, and small tree seedlings. It is a very effective tool for clearing new growth along the trail.

**Tips:** Weed whips come in two basic varieties—L-shaped and triangular-framed. The second variety is more stable, cuts larger material, and is recommended. It is fairly easy to break the wooden handle—for this reason, consider the Suwanee Sling.

**Safety:** Plenty of space should be left between the user and others. The handle should be held firmly in both hands and swung rhythmically back and forth. Strong swings should be made to prevent the blade from bouncing or glancing off springy growth. The tool should be carried or stored with a sheath in place. PPE includes leather gloves and leather boots.

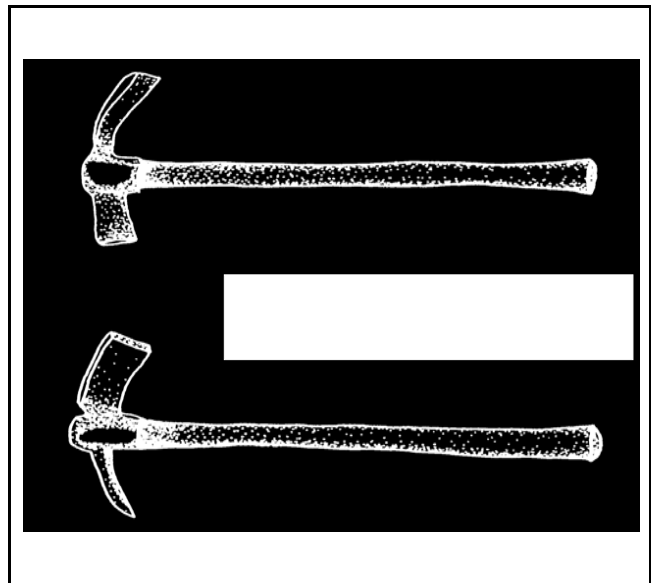


### Suwanee Sling

- Uses:** This is essentially a heavy duty weed whip that also has an axe blade. It does the same work as the weed whip, but can also cut through larger materials that may be occasionally encountered.
- Tips:** The tool's heavier weight allows it to more easily cut off larger material than a weed whip.
- Safety:** Same as a weed whip.

### **Pick Mattock and Cutter Mattock**

- Uses:** A mattock is a heavy, strong, and popular tool that may be used for the roughest of work. Its primary use is for digging and moving dirt and rocks, cutting through roots, and unearthing boulders. It is especially useful when building new trail (especially sidehill trail), installing steps and waterbars, and other heavy work. The mattock's heavy weight allows it to move more material with less effort.



There are two kinds of mattocks—pick mattocks and cutter mattocks. Both have an adze blade, but the pick mattock has a pick, opposing the adze, whereas the cutter mattock has a cutting blade. The pick mattock is most useful in hard or rocky soil where the pick is useful to break up the soil or pry out rocks. The cutter mattock is more useful in deeper, rooty soil where the cutter is needed to sever roots.

- Tips:** As with other swinging tools, the user should blend force with accuracy.
- Safety:** Choking up on the handle should be avoided—a glancing blow may strike the user. If breaking rock, goggles should be worn. PPE includes heavy leather boots and leather gloves.

### **Pulaski**

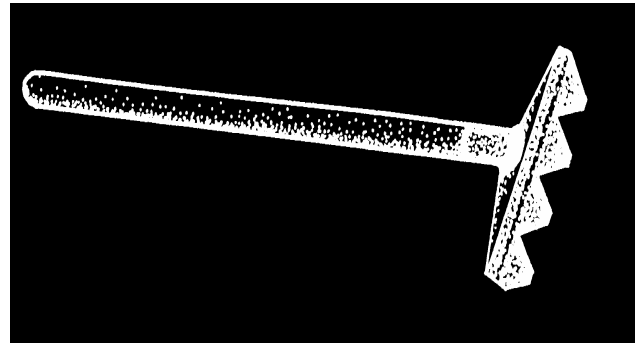
- Uses:** The pulaski combines the blade of an axe with a narrow grubbing blade. It was developed for fighting forest fires, but is also helpful in trail work. It is not as balanced or safe as the axe, nor as efficient as the mattock for moving soil, but it serves two purposes and saves weight if tools need to be carried long distances. If considerable amounts of axe work or mattock work are needed, the pulaski is a poor choice.
- Tips:** The axe end is sharpened and maintained like an axe, and the mattock end is sharpened like a true mattock. The pulaski's mattock blade can serve as a substitute adze if it is sharpened to a keen edge. If a pulaski is going to be used as an adze, it should not be used for any other purpose.
- Safety:** The pulaski can be dangerous due to its two sharp blades. It should always be stored and carried in a sheath. The same safety practices as used for an axe should be followed. PPE includes a hardhat, leather gloves, and heavy leather boots. Inexperienced users should have shin guards and possibly hard-toe boots.

## **McLeod**

- Uses:** Constructing and maintaining trail. The McLeod is a heavy-duty combination hoe and rake. It has six digging (or rake) teeth opposite the hoe blade. It is useful for removing duff layers and loose ground debris to create a level trail. It can also be used to chop off light brush and roots. It must be supplemented with a mattock or other digging tool when there is considerable digging or heavy brush.
- Tips:** The hoe blade should be kept sharp.
- Safety:** Adequate space between workers should be determined before swinging this tool. Leather gloves are recommended.

## **Council Rake (Fire Rake)**

**Uses:** Constructing and maintaining trail. The council rake looks like a section of sickle bar mower on the end of a straight handle. It is used for the same purposes as a McLeod.



**Safety:** A sheath should be in place during transport. Leather gloves are recommended.

## **Shovel**

**Uses:** Digging and moving soil and other granular material. Shovels are used for cleaning waterbars, culvert outlets, and diversion ditches. They are also used for leveling a base for sill rocks, steps, etc. In trail work, long handled, round-pointed shovels are almost exclusively used. A variation is the fire-shovel which has the advantage of being lighter weight and easier to carry.

**Tips:** The blade, including most of the blade's sides, should be kept sharp. A firefighter stance should be taken to more effectively and safely move material—the user should bend at the knees and rest the elbow of the hand holding the forward end of the handle on the inside of his/her knee. This is the power hand. The other hand holds the end of the handle and serves as the guide hand. The user should swing from side to side, keeping the elbow on the knee, cutting the soil with the side of the shovel that is opposite the power hand and moving it laterally with the continuation of the swing. For right handers, the power hand is the right hand and the right elbow rests on the right knee. Cutting is done with the left edge of the shovel and material is moved to the left. This technique does not work when digging a deep hole or ditch. The advantage is that the power comes mostly from the leg muscles—not the back muscles.

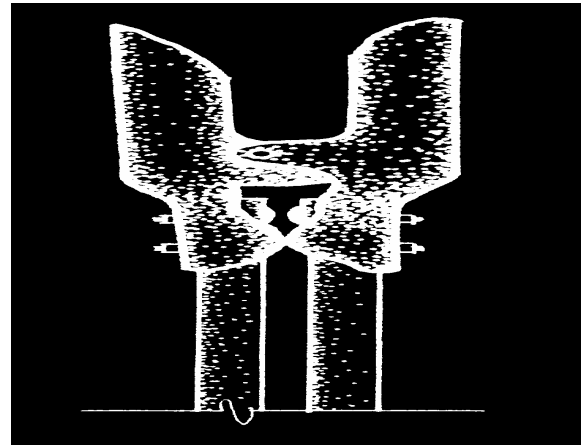
**Safety:** The most common injuries when using a shovel are back injuries. Bending from the knees instead of the waist will help prevent injury. Leather gloves are recommended.

## Posthole Digger

Uses: Digging holes for footings, posts, etc.

Tips: There are two basic types of post hole diggers—clam-type and auger-type. The clam-type is the most versatile of the two and can be used in a wide variety of soils. The auger-type works well only in sandier, dryer soils. It will not work in rocky soils and it is hard to clear of excavated material if the soil is wet.

Safety: Soil should be lifted from the hole with leg muscles—not back muscles. If the wooden handles are too flexible or the collar becomes bent, fingers can get pinched when the handles are closed. Leather gloves are recommended.



## Sledgehammer

Uses: Breaking rocks, driving posts or stakes, nudging a heavy timber into place, driving large spikes. Sledgehammers are primarily used during construction phases.

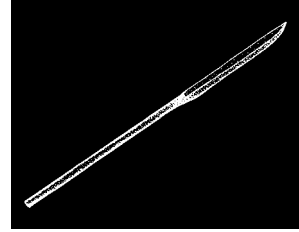
Safety: Before swinging, the user should make sure others are clear and obtain a firm stance with feet spread to shoulder width and firmly planted. PPE includes leather gloves. When striking rocks, goggles should be worn.

## 2½ or 3-Pound Hammer

Uses: Driving survey stakes, spikes, and other uses that are too demanding for a regular claw-hammer, but do not require the heavy duty blows of a sledge.

## Crowbar (Rock Bar)

**Uses:** This is an essential tool for prying and levering large, heavy objects such as boulders, logs, and beams. Crowbars are heavy-duty steel and vary in length, weight and diameter. In general, crowbars have a chisel tip on one end and a rounded handle on the other. They are usually 1" to 1½" in diameter and vary between 40" and 62" in length.

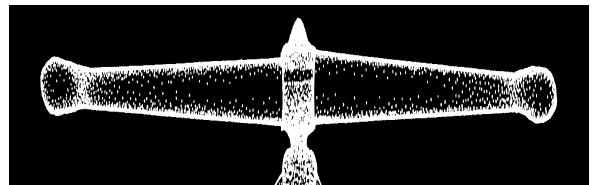


**Tips:** For most purposes, a 54" size seems to work best.

**Safety:** Since the crowbar often lifts and moves heavy loads, it can be dangerous. Fulcrums and footholds should be secure. The user should stay out from under the bar and the load being moved, and avoid levering with the bar between his/her legs. Undivided attention should be given during use to avoid mashed fingers and toes or other injuries. As with any lifting device, the user should lift with the legs—not the back. PPE includes leather gloves and heavy leather boots. For additional safety, hard-toe boots are advisable.

## Log Carrier

**Uses:** Carrying and moving heavy logs and timbers. The log carrier looks like a giant ice tong with long wooden handles. It is a two-person tool.



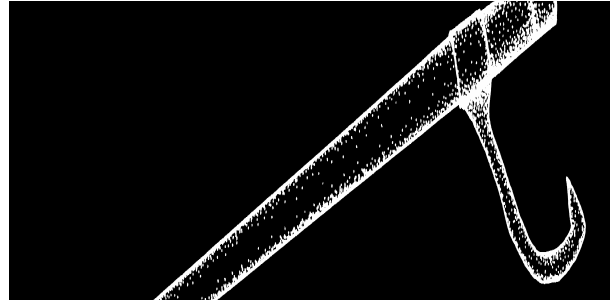
**Tips:** Many hands make light work. There is no rule that says how many log carriers and pairs of people should be assigned to a log. As many log carriers and people should be used as will comfortably fit along the length of the log to make the load manageable.

**Safety:** The user should stand behind the handle of the carrier, facing the direction of travel and place both hands on the handle, bend at the knees, and all workers lift at once. Forearms should be roughly parallel to the ground when in the lifting and carrying position. Heavy weights are involved so

caution should be used. Feet should be kept from under the log. PPE includes heavy leather boots and leather gloves.

## **Peavy or Cant Hook**

**Uses:** Rolling and positioning logs and timbers. This includes rolling the log to move it to another site or to rotate it in place. The main difference between these two tools is the shape of the tool's end. Peavys have a straight spike at the end whereas cant hooks have a short gripping tooth. Both are used for essentially the same purpose. Peavys are quicker to reposition when rolling a log some distance and for maintaining momentum. Cant hooks provide for more precise rotating. When arranged as opposing pairs, either tool can serve as a log carrier if a true log carrier is not available.



**Tips:**

**Safety:** The user should exercise caution not to roll logs onto his/her (or someone else's) toes. Logs may roll too fast and get away. Potential for severe injury is present whenever heavy weights are being moved. PPE includes leather gloves and heavy leather boots. Hard-toe boots provide an extra measure of protection.

## **Wheelbarrow or Two-Wheel Cart**

**Uses:** Moving loose material or supplies considerable distances.

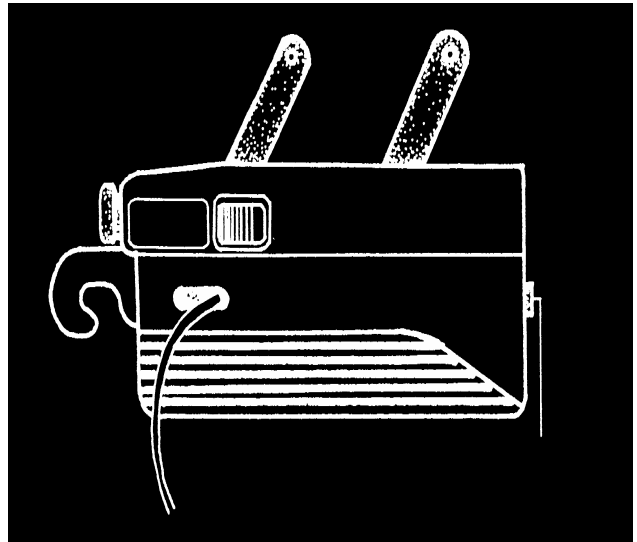
**Tips:** Two-wheel carts have better balance and can often carry heavier loads—however, they require wider space to maneuver. Whether a wheelbarrow or a two-wheel cart, models should be obtained with large balloon tires. The small-wheeled garden variety is useless for trail work.

## **Cable Winch**



**Uses:** To drag or swing heavy rocks or logs into place. When construction projects involve heavy stone or wood, ordinary hand tools may be insufficient.

**Tips:** The most common and simplest winch is the ratchet-and-pawl cable winch, usually known as a come-a-long. These range from \$9.99 hardware store models to more substantial come-a-longs capable of pulling heavier loads. The inexpensive models are useless except for the lightest of jobs. The better models can move substantial loads without breaking but are limited by the length of cable that can be wound around the spool (usually about 25'). Because of this limitation, hauling material a considerable distance requires frequent re-anchoring of the winch.



What seems to be the most popular cable winch among trail workers is a more sophisticated model known as the Griphoist® Winch. In addition to being a very strong winch, its biggest advantage is that it is a continuous cable puller. In other words, a cable of any length can be used. This allows for long pulls without having to re-anchor. These hand-powered winches use a pair of wire rope grips to pull a separate length of cable through the winch. Using the Griphoist®, a trail worker can stretch a cable all the way across a stream or ravine and pull a bridge timber into place. They also provide the basic lifting power for a “rigging” system.

Nylon slings should be used to anchor the winch to a tree and to harness rocks or logs. Chains can also be used, but in most situations the nylon sling can do the same job with less weight and less damage to the anchor tree. The winch cable should be kept freely suspended, rather than dragging it through dirt or rock, to avoid fraying and deterioration of the cable.

**Safety:** The user should stay out from under the load. Where the load may roll free and tumble or slide dangerously, a barrier should be built to stop it. PPE includes leather gloves, boots, and hardhats.

## **Rigging**

**Uses:** Rigging refers to a system of cables, pulleys, and winches used to suspend and move heavy loads to a work site or into place. Rigging systems, powered by Griphoist® winches, can empower small crews to do great things.

**Tips:** The set-up and use of a rigging system requires a sophisticated level of knowledge and special training or experience. It should not be attempted without this knowledge as severe accidents, caused by the heavy loads or a breaking cable, could occur.



Rigging systems are most appropriate when there is a considerable amount of work to do at one site—such as when constructing a bridge, retaining wall, steps, or shelter. On this type of project a crew will not want to go back to the old method of brute force once they acquire the skill to effectively utilize rigging.

**Safety:** Similar to the safety practices shown under cable winches, but even more critical with rigging because the heavy loads are suspended and can fall on workers.

## Hydraulic Jack

**Uses:** Raising heavy weights such as a corner of a shelter that has settled, or a bridge beam so that shims can be placed or the abutment build up. Can also be used to level heavy stone steps or any other structure—as long as room can be created to insert the jack under the object.

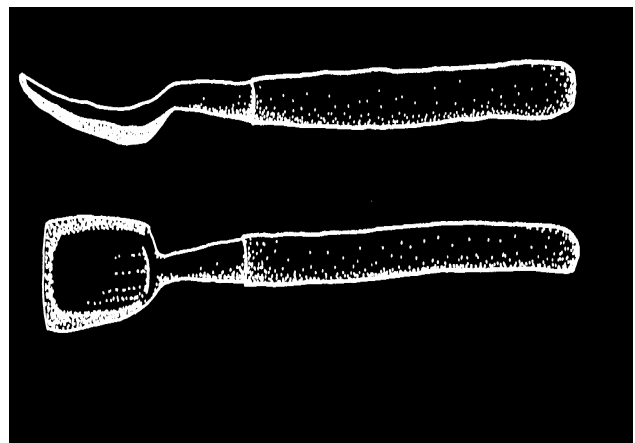
**Safety:** When working under heavy objects, there is always the danger of having it fall and crush whatever is under it. Extreme caution should be used when any part of the body is beneath the structure until it is securely in place.

## Adze

- Uses:** An adze is essentially a form of a plane. Its use is for finishing (hewing) of beams and logs to form a flat surface—such as the walking surface of a native log bridge.
- Tips:** This tool should be kept very sharp and used only for hewing. It should be handled very carefully and contact with the ground avoided. It should always be protected with a sheath. A good adze is hard to find—a source is where old tools are sold.
- Safety:** The user should exercise caution so as not to cut his/her feet or shins. When standing on the log being hewed, the toe of the front foot should be elevated so that a glancing blow strikes the bottom of the sole of the boot. Only the back of the heel of the front foot should be resting on the log. PPE includes heavy leather boots and leather gloves.

## Spud

- Uses:** Also called a bark spud, this tool is used to push and pry the bark from green timbers. Removing the bark slows the rotting process. Although an axe can be used to remove bark, a spud peels much faster, particularly during the spring and early summer.
- Tips:** The spud has three cutting

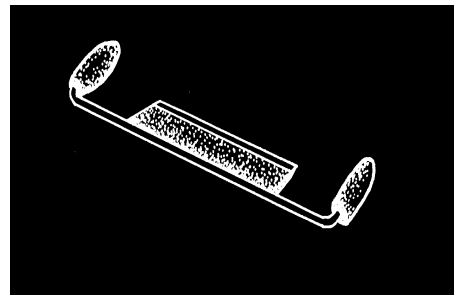


edges. All three should be sharpened on the top side only. A file should be used—a fine edge is unnecessary. Timbers peel much easier during the spring when the sap is flowing freely. Logs can be peeled in the spring and stockpiled for later use during the construction season.

**Safety:** The user should always push away from the body and keep hands and feet, as well as other workers, away from the front of the blade. Spuds often slip and can make serious wounds. Leather gloves are recommended.

## **Draw Knife**

**Uses:** Peeling small diameter logs and poles or performing finish work on timber surfaces. Draw knives are normally used on smaller diameter material than are spuds, but on difficult to peel logs can out-perform spuds.

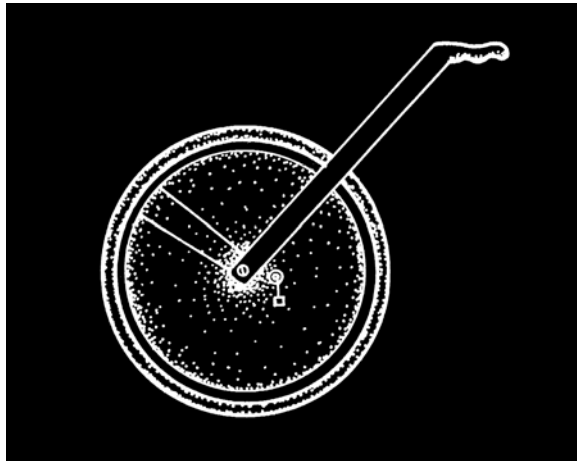


**Tips:** Users should acquire a true draw knife that has its handles at a right angle to the blade—rather than a bark knife that has handles in line with the blade. Bark knives are meant only for smoothing rough bark—not removing it.

**Safety:** Draw knives are razor sharp so caution is necessary. Leather gloves are recommended.

## **Measuring Wheel**

**Uses:** Measuring trail that is completed or under construction.



## **POWER TOOLS**

When the situation allows, the use of power tools is appropriate along much of the North Country NST. In most situations, power tools can substantially increase production. They allow fewer people to construct or maintain a given amount of trail in less time. However, they have certain drawbacks which must be recognized. Power tools can increase the potential for an injury—especially in the hands of unskilled workers. Users must be particularly cautious to prevent injury to themselves or their co-workers and must wear PPE at all times. Power tools are generally heavier to carry than hand tools. They may not be worth the extra effort if long distances are being covered where only incidental work will be performed or the worksites are widely scattered. And, of special importance, they are prohibited in Primitive ROS areas (formally designated wilderness areas).

### **Chainsaw**

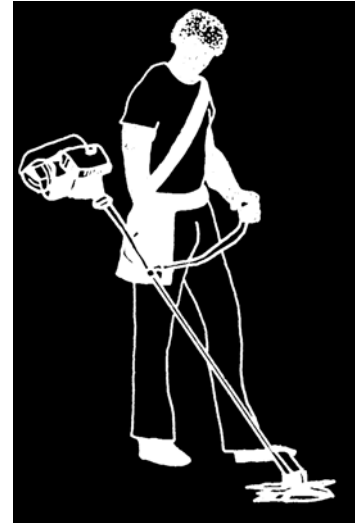
- Uses:** Cutting medium to large size blowdowns, clearing heavy sapling growth during trail construction, cutting trees into pieces for wood construction projects.
- Tips:** Saws with 16" blades are generally adequate for most trail work. Models should be obtained with chain brakes, vibration damped handles, and high quality mufflers. The user should carry a tool kit in a pack (file, srench, plastic wedge).
- Safety:** Chainsaws are one of the most dangerous pieces of power equipment. They should be used only by experienced workers (preferably those who have undergone training and are certified for chainsaw use). Required PPE includes leather gloves, ear muffs, eye protection, hardhat, and

kevlar (or similar) saw chaps. Chainsaws should not be operated without the above PPE.

## Brushsaw

**Uses:** Constructing and maintaining trail through areas of heavy brush, grass, briars, and sapling sized trees. They allow one person to rapidly clear large areas. In some situations a DR Mower® can accomplish the same tasks easier and quicker—especially in grass and smaller brush.

**Tips:** Brushsaws come in a variety of sizes. Trail work requires a more powerful unit than one that is used for lawn trimming. Generally, a brushsaw with an engine of 35cc to 80cc and bicycle-type handlebars is recommended. For durability, a known brand such as Stihl, Husquevarna, or Jonserud should be obtained. These saws also come with a variety of blades depending on the material to be cut. Trail work requires a saw type or a universal grass-brush blade—not a string cutter.



The brushsaw is supported by a shoulder harness, but can still become very tiring. Users should work in teams to make the job easier and switch positions regularly. When not cutting, the other person can remove brush from the trail.

A stout, flexible forked sapling (about 1" in diameter at the base) that has been cut about 4 ½' to 5' in length (with about a 10" fork at the end) is a very useful tool for flinging small limbs out and away from the trail. When following someone who is using a power brush saw, it is also an excellent tool for flinging the cut brush out of the trail. Its natural springiness allows it to be used like a pitchfork. This scatters the brush so that it is not visibly concentrated, and is more efficient than bending to pick up and discard each piece by hand.

**Safety:** The brushsaw's open blade is on the end of a wand, and can snag and swing violently to the side, making it more prone to injure other workers rather than the operator. Other workers should stay clear. Required PPE is ear protection, eye protection, gloves, leather boots. Hardhats are recommended.

## **Lawnmower**

- Uses:** An ordinary side-discharge mower can be effectively used for clearing and maintaining trail—except in extremely rocky terrain. For grass, ferns, and weeds (up to knee high) many feel that a lawnmower is more effective than a brush saw. It is more readily available and less expensive than a DR Field Mower®, but not as durable or powerful.
- Tips:** A mower with a 22" to 24" cut and adjustable wheels seems to work well. Wheels should be set as high as possible. A mower with a universal blade for easy replacement is desirable.
- Safety:** Rotary mowers can throw objects, injure others, and can cause severe injury to the operator's extremities if a hand or foot gets under the mower deck. The operator should insure that other workers keep a considerable distance from the mower so that thrown objects do not cause injury. Extra caution should be used when operating on slopes, or if the vegetation is wet, to avoid slips and possible operator injury (see owners manual). Sturdy leather shoes (not jogging shoes) should be worn. Ear protection should be worn if using the mower for extended periods or the muffler is louder than 80db.

## **DR Field Mower®**

- Uses:** This sturdy mower is an excellent choice for cutting heavy grass, weeds, briars, and even saplings up to 1" diameter. A DR Field Mower® is simply a walk-behind brush-hog that is useful during trail construction and trail maintenance. It is more useful than a sickle-bar type mower because the material is chewed up and does not need to be removed from the trail as much as with a sickle-bar mower.
- Tips:**
- Safety:** The mower can throw objects and injure others. Other workers should be kept at a safe distance away from the mower. PPE includes ear protection and leather gloves.